



INDEX DEPARTMENT.

ANNUAL SUMMARY.

It is proposed to furnish, in this department, as complete an Index as may be of current engineering literature of a fragmentary character. A short note will be appended to each title, intended to give sufficient information to enable the reader to decide whether or not it is worth his while to obtain or consult the paper itself. The Index will be mostly limited to society and magazine articles, and special engineering reports of general interest and value. It is printed in the monthly issues of the JOURNAL, on but one side of the paper, so that the titles may be cut out and pasted on cards or in a book, and is here collected with additional titles and many cross-references.

All readers of the JOURNAL are requested to aid in making the Index as complete as possible. All notices for this department, and all matter to be here indexed should be sent to J. B. JOHNSON, Manager Index Department, Washington University, St. Louis, Mo.

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- Address, Annual, to the Engineers' Club of Philadelphia.** By T. M. Cleemann, retiring President. Gives a comparison of the growth of engineering societies and a brief review of the work Philadelphia and Pennsylvania have accomplished. *Proc. Engrs. Club, Philadelphia*, Vol. VI., pp. 225-234 (Feb., 1888).
- *of Retiring President, Engineers' Club of St. Louis.* By Wm. B. Potter. Gives brief history of the club and discusses its work and relations with other societies. *Jour. Asso. Engin. Soc.*, Jan., 1888, pp. 22-28.
- *President's, Society of Engineers.* By Henry Robinson. Reviews engineering progress during the year. *Trans. Soc. Engrs.*, 1888, pp. 1-26.
- *President's, Illinois Society of Engineers and Surveyors.* By I. O. Baker. Points out desirable changes in engineering practice of building roads, bridges, etc. *Rep. Ill. Soc. Engrs. and Surveyors*, 1888, pp. 14-27.
- *to the Institution of Civil Engineers.* Gives the address of Geo. B. Brace on assuming the President's chair. A general review of engineering. *Engineer*, Nov. 11, 1887.
- *to the Mechanical Science Section of the British Association, Bath, 1888.* By W. H. Preece, President of the section. Reviews the developments of the practical applications of electricity. *Engineer*, Sept. 7, 1888; *T. J. and Elcc. Rev.*, Sept. 7, 1888; *Jour. Soc. Arts*, Sept. 14, 1888; *Sci. Am. Supple.*, Sept. 29, 1888.
- Aluminum Alloys by the Heroult Process.** Describes the method of producing aluminum alloys; also gives a table showing tensile strength and elongation obtained from a series of tests made at Zurich. *Engr. News*, Sept. 8, 1888.
- *Influence upon Cast-Iron.* By W. J. Keep, Prof. C. F. Maybery and L. D. Voice, before the American Association for the Advancement of Science. A valuable paper, giving details of experiments made to determine the effects of aluminum on cast-iron. Good results were obtained by its use. *Sci. Am. Supple.*, Sept. 8, 1888.
- *Recent Development of the Cowles Process.* By R. E. Crompton, before the Bath meeting of the British Association. Gives a description of the new plant for the production of aluminum at Milton, Eng. *T. J. and Elcc. Review*, Sept. 14, 1888.
- Alloys, Copper-Tin.** A preliminary experimental research upon the mechanical properties of small castings of the alloys of copper and tin. Transverse, tension, torsion and compression tests in detail, with 81 plates and diagrams. By R. H. Thurston, Chairman. *Report Board of Testing*, etc., 1881, Vol. I., pp. 271-451.

- Anemometers.** *Experimental Investigations and Description of the Hagemann Anemometer.* By G. A. Hagemann. Translated by G. E. Curtis from the "Annuaire Météorologique" of the Danish Meteorological Institute, Copenhagen, 1877. *Journal of the Franklin Institute*, Sept., 1887, Vol. CXXIV., No. 741.
- Angle Prisms.** Discusses the construction and uses of angle prisms. *Eng. News*, May 12, 1888.
- Aqueduct, Croton, Method of Detecting Bad Work.** Gives a brief description of the methods employed to detect and repair the bad work on the Croton Aqueduct. *Engr. News*, Oct. 13, 1888.
- , *Croton, Tunnel Excavation.* A contractor's side of the tunnel excavation question. *Engr. News*, Oct. 20, 1888.
- , *Zempoala, Mexico.* Gives an illustrated description of Zempoala aqueduct, supplying the city of Otumba, which was built during 1553-7. *Engr. News*, July 7, 1888.
- Arch, Construction of a Skew.** By M. P. Paret. Gives a history of interesting points on the construction of a skew arch on the Cincinnati & Richmond R. R., near Red Bank, O. *Engineering News*, Oct. 20 et seq., 1888.
- , *Stone, over South Street, Boston & Providence R. R.* Gives description, with plan, elevation and sections, of the stone arch of 40 feet span to replace the Bussey bridge. *R. R. Gaz.*, Dec. 30, 1887.
- Arches.** An abstract of a paper before the Engineering Section of Bristol Naturalist Society by Mr. C. Richardson, Engineer to Severn Tunnel. *Engineering*, Jan. 13, 1888. *Sci. Am. Supple.*, March 3, 1888.
- , *Arched Ribs and Voussoir.* By Mr. Martin, before a students' meeting of the Institution of Civil Engineers. Gives a mathematical discussion of arched ribs and voussoir arches. *Proc. Inst. C. E.*, Vol. XCIII., pp. 462-477.
- of long span and small rise, constructed with a joint at crown and springings of a hinge-like form, by insertion of lead plates in the middle third of these joints. Four such bridges described, erected 1885-87. Very good. *Zeitschrift für Bauwesen*, 1888, p. 235.
- , *Stone.* Discusses the problem of the stone arch as designed from the catenary curve. *Eng. News*, Nov. 19, 1887; *Mech. World*, Dec. 17, 1887.
- Asbestos.** By S. A. Rogers, before the Chemists' Assistants' Association. Reviews the history, occurrence and properties of asbestos. *Sci. Am. Supple.*, June 16, 1888.
- Axle, Standard for 60,000-lb. car.** A paper by A. Forsyth, presented to January meeting of Western Railway Club by the committee on axles as their report. It discusses dimensions and loads, factor of safety and friction. *Mast. Mechanic*, Feb., 1888.
- , *Standard for 60,000-lb. car.* By H. C. Meade, before January meeting Western Railroad Club. Gives comparison between the Johann and M. C. B. axles. *R. R. Gazette*, Feb. 10, 1888; *Mast. Mechanic*, Feb., 1888.
- Axles, Effects of Temperature on the Strength of.** By Thos. Andrews. Abstract of a paper before the Institution of Civil Engineers, giving valuable experimental research on the effect of varying temperatures on the resistance to impact of railway axles. *Engr. News*, Feb. 18, 1888.
- , *Steel Car.* A paper by John Coffin before the Philadelphia meeting of the American Society of Mechanical Engineers. Discusses the treatment of the axle after it is forged. *Trans. Amer. Soc. Mech. Engrs.*, Vol. IX. (1888), pp. 135-160; abstracted *R. R. Gazette*, Dec. 23, 1887.
- See Car Axles and Car Wheels.
- Batteries, Primary, for Illuminating Purposes.** By Perry F. Nursey, before the Society of Engineers. Treats briefly the principles of the primary battery, outlines its history and then describes in chronological order the various batteries brought out. *Trans. Soc. Engrs.*, 1888, pp. 185-223.
- Belting. Origin and Progress of Leather Belting.** With description of leath link belting. Paper read before the National Electric Light Association, Pittsburgh by Charles A. Schieren. *Electrical World*, March 3, 1888; *Electrical Engineer*, March, 1888; *Age of Steel*, March 10 and 17, 1888.
- Blowers, Experiments and Experience with.** By H. I. Snell, before the Philadelphia meeting of the American Society of Mechanical Engineers. *Trans. Amer.*

- Soc. Mech. Engrs.*, Vol. IX. (1888), pp. 51-73; *Am. Engr.*, Nov. 23, 1887; *Mech. World*, Dec. 17, 1887.
- Boiler, Efficiency of a, Using Waste Gas as Fuel.** By D. S. Jacobus, before the Birmingham meeting of the American Institute of Mining Engineers. Gives the results of trials made to determine the efficiency of a water-tube boiler with waste gas from a blast furnace as fuel. *Am. Eng.*, Aug. 15, 1888; *Eng. News*, Aug. 15, 1888.
- , *Essex Vertical.* Describes a new internal arrangement adopted for small vertical boilers. *Engineer*, Dec. 9, 1888.
- , *Firmenich, Failure of a.* By C. F. White, before the Engineers' Club of St. Louis. Gives results of examinations as to the cause of explosion of a Firmenich boiler. *Jour. Assoc. Engin. Soc.*, August, 1888, Vol. VII., pp. 329-335; *R. R. Gazette*, Sept. 7, 1888.
- , *Locomotive, Belpaire Type.* Gives detailed drawings of a 56-inch straight top boiler designed for the new Mogul engines on the Chicago, Burlington & Quincy Railroad. *Master Mechanic*, March, 1888.
- , *Water Tube, Trial of a.* By R. H. Thurston. Gives very full details of a test of a Babcock-Wilcox water-tube boiler at Sibley College, Cornell University. *Sci. Am. Suppl.*, April 14, 1888.
- Boilers, Circulation in.** See Locomotives.
- , *Deterioration of.* By J. M. Allen. A Sibley College lecture, treating of errors in boiler construction, and of the natural cause of their deterioration. Illustrated. *Sci. Am. Suppl.*, June 9, 1888.
- , *Gas Fired.* Gives a description of Frederick Siemens' improvement in generating steam with gaseous fuels. *Sci. Am. Suppl.*, March 31, 1888. *Am. Manufacturer*, May 11, 1888.
- , *Joints in.* See Riveted Joints.
- , *Pressure in Marine.* By Richard Sennett, before the Institution of Naval Architects. Discusses working and test pressures for marine boilers. *Engineering*, March 30, 1888.
- , See Oil Burners for.
- , *Specifications for.* By C. G. Darrach, before the Philadelphia Engineers' Club. Gives general specifications for boilers which require the bidder to state not only the price for the entire work, including boiler, setting, fixtures, etc., but also the economy and capacity he will guarantee. Discussed. *Proc. Engrs. Club*, Philadelphia, December, 1887, Vol. VI., pp. 179-206.
- , *Strains in Locomotive Boilers.* A paper read at the Nashville meeting of the American Society of Mechanical Engineers. By L. S. Randolph, Mount Savage, Md. Showing that the failure of locomotive boilers is generally due to unequal expansion and contraction of the fire-box sheets. *American Engineer*, May 16, 1888.
- , *Use of Kerosene Oil in.* A paper by L. F. Lynes before the American Society of Mechanical Engineers. Gives practical experience in using kerosene oil in steam boilers to remove and prevent scale. Advocates its use. *Trans. Am. Soc. Mech. Engrs.*, Vol. IX. (1888), pp. 247-258; *Amer. Engr.*, Nov. 30 and Dec. 7; *Power*, December, 1887; Abstract in *Eng. and Build. Rec.*, Dec. 31, 1887; *Sci. Am. Suppl.*, Feb. 11, 1888.
- , *United States Government Rules for Marine Boiler Pressures.* Pressure allowed for various thicknesses and qualities of plates, flues, etc. *Mechanics*, January, 1888.
- , *Water Tube.* Discussion on their uses and drawbacks. *Engineer*, Oct. 7 and 28, 1887.
- Boiler Experiments and Fuel Economy.** By J. Holliday, before the students' meeting, Institution of Civil Engineers. Gives details of experiments made to increase the efficiency and economy of a certain boiler. *Proc. Inst. C. E.*, Vol. XCII., pp. 336-352.
- Brake, Eames Vacuum.** Full description, with detailed drawings, of the Eames vacuum brake. *Engineer*, March 16, 1888; *Sci. Am. Suppl.*, April 21, 1888.
- , *Manomatik.* Gives a description of the Manomatik lever momentum brake which is operated by power transmitted from the drawheads through buffer springs. Illustrated. *R. R. Gazette*, March 23, 1888.
- , *Suggestions of Radical Changes in Automatic Brakes,* especially for freight

trains. The main feature of improvement suggested is that the power of the brake should increase with the *load* in the car. By A. K. Mansfield. *The Railroad and Engineering Journal*, January, 1888.

Brake Tests, Westinghouse. Gives details of the test made at Weehawken with a train of 50 empty freight cars. *Eng. News*, Nov. 25 1887; *R. R. Gaz.*, Nov. 25, 1887; *Nat. Car and Loco. Builder* for December, 1887. Gives table of the tests at various places.

Brakes, Classification of Continuous Railroad. By A. W. Metcalfe, before the Students Institution of Civil Engineers. Gives a classification of railroad brakes based upon the general principles of action. *Proc. Inst. C. E.*, Vol. XCII., pp. 315-335.

—, *Freight Train.* Gives a paper by Mr. Lauder, and the discussion that followed it at the December meeting of the New England R. R. Club. *R. R. Gaz.*, Dec. 23, 1887, also *Mast. Mechanic*, January, 1888.

—, *Freight.* A paper by H. H. Westinghouse before the New York Railroad Club. Describes the construction, operation and maintenance of brakes. With discussion by the Club. *Mast. Mechanic*, February, 1888; *R. R. Gazette*, Jan. 27, 1888.

—, *Buffer.* A brief article explaining, with formulæ, the nature and action of buffer brakes. *Master Mechanic*, April, 1888.

Bridge, Arthur Kill. Gives a brief description, with plan and details of the draw-bridge recently constructed between Staten Island and New Jersey. Total length of draw, 496½ feet; clear water-way, 206 + 204 feet. *R. R. Gazette*, June 22, 1888.

—, *Brunswick, Eng.* Gives two-paged plate showing elevation and details of a hinged-arch foot bridge, spans 79 feet, over the River Oker at Brunswick, England. *Engineering*, Aug. 17, 1888.

—, *Ben Rhydding, Eng.* Gives brief description with two-page plate of detailed drawings, of two lattice arches, with suspended roadway, over the River Wharfe near Ben Rhydding, Yorkshire. *Engineer*, May 25, 1888.

—, *Big Warrior River.* Gives a brief description of a 300-foot through span over the Big Warrior River, near Cordova, Ala., with full detailed drawings. *R. R. Gazette*, June 29, 1888; *Sci. Am. Sup.*, July 21, 1888.

—, *Brooklyn.* Gives report of the Committee on Terminal Facilities, and the adopted plans for the terminals. *Engin. News*, April 21, *et seq.*, 1888; *R. R. Gazette*, April 27, 1888; *Engin. and Build. Rec.*, April 21, 1888.

—, *Brooklyn, Enlarging the Capacity of the.* Gives the report of the Board of Experts on the plans for enlarging the capacity of the Brooklyn bridge; also the report submitted to the Board by Mr. A. M. Wellington. *Engr. News*, March 17, 1888.

—, See Foundations.

—, *Cairo.* By S. F. Balcom. Gives brief description of the Cairo bridge, and describes some of the details of construction and progress of the work. *Rept. Ill. Soc. Engrs. & Surveyors*, 1888, p. 75-84; and *Railroad Gazette*, June 1, 1888.

—, *Cantilever, Lachine.* Gives description with a two-page plate, with details of the bridge across the St. Lawrence River. *Engineering*, April 13, 1888.

—, *Cantilever, Sukkar.* By Wm. Parsey. Gives a description of staging and temporary erection of the Sukkar cantilever bridge at the bridge works. The bridge has a span of 820 feet, with a centre span of 200 feet. A two-page plate gives details of staging, etc. *Engineering*, March 2, 1888.

—, *Chenab, India.* Gives two pages of detailed drawing and abstracts from the specifications of the Chenab bridge, India state railroads. It is composed of 17 spans, of 206 feet each, of riveted triangular girder. *Engineer*, Sept. 14, 1888.

—, *Draw.* See Draw-bridge.

—, *Forth.* By F. E. Cooper, before the Iron and Steel Institute. Gives a general description of the methods employed in the erection of the various portions of the main span. Abstracts in *Engineer*, Aug. 24, 1884; *Engr. News.*, Sept. 22, 1888; *Sci. Am. Supple.*, Oct. 13, 1888.

—, *Forth, Erection of.* By A. S. Biggart. A paper before the British Association, treating of the problems that occurred during the erection of the Forth bridge and methods of overcoming them. Illustrated. *Engineer*, Nov. 25, 1887; *Sci. Am. Sup.*, Dec. 31, 1887.

—, *Forth, Erection of Superstructure.* By A. S. Biggart, before the Scotland In

stitution of Engineers and Shipbuilders. Describes briefly the principal features of erection of the superstructure of the Forth bridge. *R. R. Gazette*, May 18, 1888.

Bridge, Forth. Fife Cantilever Pier. A two-page plate of the Fife cantilever pier of the Forth bridge, showing all of the main tubes and connections, including junction girders completed to the full height of 362 feet, the north cantilever carried out 170 feet, the first struts and braces to a height of 210 feet, and 130 feet of the viaduct completed. *Engineer*, Feb. 3, 1888. A small view of the same in *Engineering*, Jan. 27, 1888, also *Engr. News*, March 10, 1888.

—, **Fort Madison.** By W. W. Curtis. Gives a good description of location and construction of Chicago, Sante Fe & California railroad bridge across the Mississippi River at Fort Madison, Ia., with cuts showing details of caisson and piers. *Engin. News*, June 2 and 9, 1888.

—, **Hackensack Draw.** Gives description of new draw-bridge recently built by the Erie Railroad over the Hackensack River, with drawings showing details of girders, turn-table, wedges and foundations of draw span. *R. R. Gazette*, July 20, 1888.

—, **Harlem River.** Gives plan and elevation showing the arrangement of the plan and the condition of the work just before the last segments of span No. 2 were closed. *Eng. and Build. Rec.*, Jan. 21, 1888. False works, skewback segment and hinges are shown in *Eng. News*, Feb. 4, 1888.

—, **Harlem River.** A series of articles describing the erection of the Harlem River bridge, with details of contractors' plant, staging, etc. *Engin. and Build. Rec.*, July 14 et seq., 1888.

—, **Hawkesbury, New South Wales.** Illustrations and description of the method of erecting on pontoons and floating to place. *R. R. Gazette*, August 10, 1888; *Indian Engineer*, July 28, 1888; *Sci. Am. Supple.*, Aug. 11, 1888; *Engineer*, Sept. 7, 1888.

—, **Hawkesbury.** Gives illustrated description of the Hawkesbury bridge, with report of progress. Abstracted from the *Sidney Mail*, *Sci. Amer. Supple.*, Aug. 11, 1888.

—, **Highway, Overhead, N. Y. C. & H. R. R.** Gives details of the 60-ft. span overhead highway bridge erected in New York City. *R. R. Gazette*, Nov. 9, 1888.

—, **Jubilee Hooghly, River, India.** By Sir B. Leslie. A paper before the Institution of Civil Engineers, giving details of the construction of the Jubilee bridge carrying the East Indian Railroad over the Hooghly River at Hooghly. It has a central double cantilever 360 feet long by 5.2 feet high, and side spans 420 feet long and 47 feet deep. *Proc. Inst. C. E.*, Vol. XCII., pp. 73-141; abstract *Engineering*, Jan. 27, 1888; *Mech. World*, Feb. 4, 1887; *Engineer*, Feb. 10, 1888; *Engin. and Build. Rec.*, Feb. 4, 1888.

—, **Illinois and St. Louis.** By Theo. Cooper. Gives notes on the mode of setting and adjusting the skew backs on the insertion of the centre tube of the different spans, and the tests of the completed bridge. *Trans. Am. Soc. C. E.*, Vol. III. (1874), pp. 239-254.

—, **Kentucky and Indiana.** By Mace Moulton. A paper before the American Society of Civil Engineers, containing a full account of the construction, with extracts from specifications, tables showing tests of materials, etc., of the bridge over the Ohio River at Louisville. Plates show design, locations, strain sheet and details. *Trans. Am. Soc. C. E.*, XVII., September, 1887, pp. 111-168; abstract in *Engineering*, Jan. 27, 1887.

—, **Lifting, Tarante, Italy.** Description of a bridge at Tarante, Italy, with plates showing details. It consists of two half arcs meeting in the centre when closed; each half has a rising and rotating movement, and is worked by hand or turbines. Distance between axes of rotation, 220 feet. *Engineering*, Oct. 28, 1887, et seq. Brief description, illustrated. *Sci. Am. Sup.*, Jan. 14, 1888.

—, **Lifting, Utica, N. Y.** By Squire Whipple. Gives description, with elevation and cross-section, of a "lift-draw-bridge" over the Erie Canal at Utica, N. Y. *Trans. Am. Soc. C. E.*, Vol. III., pp. 190-194.

—, **Mannheim.** Gives brief illustrated description of five competitive designs for a bridge at Mannheim. *Engineer*, Dec. 16, 1887.

—, **Niagara, Replacing Towers of.** By L. L. Buck, before the American Society of Civil Engineers. Gives details of the work of replacing the stone towers of the

- Niagara suspension bridge with iron towers. *Trans. Am. Soc. C. E.*, Vol. XVII. (Oct. 1887), pp. 204-212; *Engineer*, Dec. 9, 1887; *Engineering*, Dec. 9, 1887; abstracted *Prac. Inst. C. E.*, Vol. XCIII., pp. 510-512.
- Bridge, Paderno, Italy.** Gives brief description, with elevation and cross section, of a bridge to be built over the river Adda, at Paderno, Italy. Length of main arch, 492 ft.; rise, 123 ft.; lattice truss spans, 109 ft.; total length, 997 ft. *R. R. Gazette*, Sept. 14, 1888.
- , *Petaluma Draw.* Gives brief description, with general view and plan and elevation, of the central pier of the Petaluma draw-bridge on the San Francisco & North Pacific Railroad. *Engr. News*, Oct. 13, 1888.
- , *Plate Girder.* See Girder.
- , *Pony Lattice, W. S. R. R.* Gives plan, elevation and cross-section, with dimensions of a pony lattice bridge truss built at Normanskill, N. Y., on the West Shore Railroad. Span, 86 ft.; clear width, 14 ft.; height, 10 ft., and weight, 50 tons. *R. R. Gazette*, Sept. 21, 1888.
- , *Poughkeepsie.* A series of articles on the erection of the Poughkeepsie bridge. *Engin. and Build. Rec.*, May 5, et seq., 1888.
- , *Poughkeepsie.* By Thomas C. Clark. The Second Sibley College lecture describing the erection of bridge over the Hudson at Poughkeepsie. *Sci. Am. Suppl.*, May 19, 1888.
- , *Proposed North River.* By G. Lindenthal. Gives brief description of the proposed bridge, also gives a full page plate comparing the bridge with four of the greatest bridges in the world. *Engr. News*, Jan. 14, 1888, and *Engr. and Build. Rec.*, Jan. 14, 1888.
- , *North River, Proposed.* By Gustav Lindenthal, before the American Society of Civil Engineers. Gives very full details of the proposed bridge over Hudson River, at New York. Proposed dimensions are: River span, 2,850 feet; two shore spans, 1,800 feet; width, 68 feet, with six railroad tracks; height above water, 145 feet. Abstracted in *Eng. News*, Jan. 28, et seq., 1888.
- , *Ravine Lowestoft.* Description, with elevation and details, of a wrought-iron arched bridge. The arch ribs are made of $\frac{1}{4}$ -inch web plate and angle iron. *Engineer*, Sept. 2, 1887.
- , *Red River, Concrete Piers.* By C. D. Purdon. Gives details of the construction of concrete piers for the St. Louis & San Francisco R. R. bridge over Red River, Texas. *Engr. News*, June 2, 1888.
- , *River Ouse, Bedford, Eng.* Gives plan, elevation and cross-section of a foot-bridge of 100 ft. span, practically without abutment. *Sci. Am. Suppl.*, Sept. 8, 1888.
- , *Staging, Sukkur, India.* A brief description, with large colored plate, of the staging for the main pillars and guys of the 820-foot cantilever span of the Sukkur bridge. *Indian Engineering*, Nov. 5, 1887.
- , *St. Louis, Reconstruction of the Floor of.* By N. W. Eayrs. Gives details, with drawings, of the plan adopted in the reconstruction of the railroad floor of the St. Louis bridge. *R. R. Gazette*, Aug. 31, 1888.
- , *Suspension, Vishwamitri River.* Short description and abstract from specifications of a chain suspension bridge of 190 feet span, with two large plates showing elevation and details. *Indian Engineering*, Dec. 10, 1887.
- , *Sin Ho, China.* Brief description, with elevations, cross section and half plans showing bracing of the Sin Ho bridge. *Engineer*, Dec. 9, 1887.
- , *Three-Hinged Iron Arch.* By J. H. Cunningham. Gives description, with details, of a three-hinged, wrought-iron arch constructed at Claremont, Ia. *Engineering*, Aug. 12, 1887.
- , *Torkham, India.* Describes the method employed to launch three short spans of riveted girder of Torkham bridge. Illustrated. *Indian Engineering*, Oct. 1, 1887; *Eng. News*, Nov. 19, 1887; *Engineering*, Jan. 13, 1888.
- , *Tay.* By Peter Barlow, before the Institution of Civil Engineers. Gives principal dimensions and general data of the Tay viaduct. *Sci. Am. Suppl.*, June 16, 1888.
- , —. By Wm. Ingliss, before the Institution of Civil Engineers. Gives details of the construction and difficulties overcome of the Tay viaduct. *Sci. Am. Suppl.*, June 16, 1888; *R. R. Gazette*, June 29, 1888.
- , *Wells Street, Chicago, Removal of the.* Gives details of the moving of the

Wells street draw-bridge, bodily, to its new position on Dearborn street. *Engin. and Build. Rec.*, April 14, 1888.

Bridge, Willamette River, Oregon. Gives elevation, cross section and details of a timber Howe truss across the Willamette River, Albany, Oregon. It has two spans 175 feet long, and a draw span 260 feet in length. *Engineering* Jan. 6, 1888; *Sci. Am. Suppl.*, March 17, 1887.

Bridges. A New Truss. By Geo. H. Pegram. Proposes a new form of truss. Gives formulas and applies them to a through span of 255 ft., etc. Valuable. *Eng. News*, Dec. 10, 1887.

—, *A Review of.* By Prof. W. P. Trowbridge. Of the development of bridge construction, with notices of some remarkable historic bridges. *Sci. Am. Suppl.*, March 17, 1887.

—, *Economical Height of Trusses for a Given Panel Width.* By John Lundie. *Jour. Assoc. Engrs. Soc.*, Vol. VII., pp. 101-103 (March, 1888).

—, *Failures.* By G. H. Thomson, before the Bath meeting of the British Association. Discusses bridge failures and their causes, and details of experiments made on various types of bridges. *R. R. Gazette*, Sept. 23, 1888.

—, *Guard Rails on.* A circular issued by the Massachusetts Board of Railroad Commissioners to all of the railroads in that State, recommending a certain form of guard rail on bridges. *R. R. Gazette*, Dec. 30; *Eng. News*, Dec. 31; *Eng. and Building Record*, Dec. 31.

—, *Highway.* By S. A. Buchanan. Discusses the construction, maintenance and repairs of short span highway bridges. *Rpt. Ohio Soc. Surv. and Eng.*, 1888, pp. 184-194.

—, *Highway.* By J. O. Wright. Discusses the present practice of building highway bridges and gives hints for improvements. *Rpt. Ill. Soc. Engrs. & Surveyors*, 1888, pp. 60-65.

—, *Highway, Computation of Strains in.* By C. M. Brown. A paper showing county commissioners and surveyors how to compute strains in highway bridge structures. *Rpt. Ohio Soc. Surv. and Engrs.*, 1888, pp. 195-203.

—, *Highway, Improved.* By J. H. Burnham. Discusses the improvements made in highway bridges. The discussion on the paper relates mostly to the use of brick in place of stone. *Rpt. Ill. Soc. Engrs. & Surveyors*, 1888, pp. 47-54.

—, *Highway, General Specifications for, of Iron and Steel.* By J. A. L. Waddell. Discusses the present practice with its evils, and gives suggestions for better methods. Address the author, Kansas City, Mo.

—, *Long Span, Discussion of.* By Gustav Lindenthal. Gives a discussion of cantilever, general features of arch bridge and suspended arches. *Engr. News*, March 3, 1888.

—, *Pile and Trestle.* By A. F. Robinson. Discusses the use of pile and trestle bridges, and gives design of the standard trestle of the Chicago, Burlington & Northern Railroad Company. *Engr. News*, April 7, 1888.

—, *Specifications for Iron.* By I. O. Baker. Gives specifications relating to ultimate strength, elongation and fractured area. *Rpt. Ill. Soc. Engrs. and Surv.*, 1888, pp. 55-57.

—, *Steel for.* See Steel.

—, See Trestles, Draw-bridges, road bed and floor beams.

—, *Test of Full-size Floor Beam.* By A. P. Boller. A paper before the American Society of Civil Engineers, giving details of the testing of a full-sized wrought-iron double track floor beam. Abstracted *Sci. Am. Suppl.*, June 2, 1888.

—, *Types of Iron Girder, Indian Midland R. R.* A series of plates giving elevations, plans and details of types of iron girder in use on the Indian Midland R. R., India. *Indian Engineering*, Aug. 25, et seq., 1888.

—, *Upright Arched.* By J. B. Eads. Endeavors to show that upright arched bridges can be more economically constructed than is possible by any other method. *Trans. Am. Soc. C. E.*, Vol. III., 1874, pp. 195-238.

Bridge Floors, Design, Strength and Cost. By Edmund Olander, before the Society of Engineers. Gives a comparison of weight, strength and cost of various designs of bridge floors. Four plates. *Trans. Soc. Engrs.*, 1888, pp. 27-67.

—, *Street.* By Carl Gayler, before the St. Louis Engineers' Club. Discusses the different kinds of floors in use and gives cost of the different classes used in St. Louis. *Jour. Asso. Engin. Soc.*, May, 1888; *Engin. and Build. Rec.*, June 30, 1888.

- Bridge Inspection.** Gives the order to bridge inspectors in use on the Buffalo, Rochester & Pittsburgh Railroad. *Engin. News*, May 12, 1888.
- , *Inspection and Maintenance of.* A discussion at the annual convention of the American Society of Civil Engineers on the inspection and maintenance of railway structures. The discussion, by many prominent engineers, covers 50 pages in the *Trans. Am. Soc. C. E.*, Vol. XVII., December, 1887.
- , *Selection and Maintenance of.* By D. W. Mead. Gives hints relating to the selection and maintenance of bridges for cities. *Rep. Ill. Soc. Engrs. and Surveyors*, 1888, pp. 65-68.
- *Pins and Eye Bars, Proportion of.* By C. F. Stowell. Discusses the present state of pin calculation and gives formula for computing the stress in the side of the head of eye-bars. *Engr. News*, March 31, 1888.
- Bridge Strains, Slide Moment Diagram for Computing.** By J. E. Greiner, before the Engineers' Society of Western Pennsylvania. Gives a description of a slide moment diagram, which has been in use in the Baltimore & Ohio office for three years, and is considered the best method of finding shears and moments in bridges. Abstracted in *Engin. News*, April 14, 1888.
- Bridges, Stresses in Lattice, New Method of Obtaining.** By Wm. Robertson. Gives a new geographical method of computing the strains in lattice bridges. *Engineer*, Dec. 30, 1887. *Sci. Am. Supple.*, March 24, 1888.
- , *Graphical Evolution of Stress in Lattice Girders.* By Wm. Robertson. Gives a comparison between the values of the stresses in the flanges of various forms of latticing as determined by their numerical evolution and the ordinate to the parabolic curves of moments, and deduces rules for graphical solution. *Engineer*, March 16, 1888.
- Bridge Work and Inspectors.** By S. T. Wagner, before the Annual Convention of the American Society of Civil Engineers. Discusses the characteristics and work of bridge inspectors and makes suggestions for their work. Discussion. *Trans. Am. Soc. C. E.*, Vol. XVII., December, 1887, pp. 319-329.
- Building Materials and their use in Fire-Proof Construction.** By S. E. Loring. An illustrated series describing the best and latest practice in the construction of fire-proof buildings. *Building*, Dec. 17, 1887, *et seq.*
- Buildings, Steel Plate.** Detailed plans and descriptions of a method of constructing buildings with embossed galvanized steel plates. *Sci. Am. Supple.*, Nov. 5, 1887.
- Cables, Chain.** A full discussion of the determination of the character of iron best adapted for chain cables, the best form and proportions of links, with details of the testing of a large number of specimens. *Report U. S. Board on Testing*, Vol. I., 1881, pp. 1-238.
- , *Steel.* Abstracts from the specifications for the steel cables for Birmingham cable roads. *Engineer*, Aug. 12, 1887.
- Cable Railroad, East River Bridge.** By G. Leverich, before the American Society of Civil Engineers. Gives a very complete description of the road, plant and particulars of traffic and operation, details of wear, renewals and changes, with 28 plates showing details. Very valuable. *Trans. Am. Soc. of C. E.*, Vol. XVII. (March, 1888), pp. 67-102.
- Cable Roads, Birmingham, Eng.** Gives a brief description, with a two-page detailed drawing, of the Birmingham cable road. *Engineer*, June 22, 1888.
- , *Edinburgh.* Gives constructive details of the Edinburgh Northern Cable Tramway, with description. *Engineer*, Oct. 23, Nov. 4 and 11, 1887.
- , *Otto System.* Describes the installation prepared for the New Castle Exhibition, with illustrations showing details. *Engineering*, April 6, 1888.
- Canal, Manchester Ship.** A series of articles describing in detail the progress made and methods employed in the construction of the Manchester ship canal. *Engineering*, May 18, *et seq.*, 1888. Abstracted *Eng. News*, June 30, *et seq.*, 1888. *Engin. and Build. Rec.*, Sept. 29, *et seq.*, 1888.
- , *Manchester Ship.* Gives brief review of the above project, with particulars of the work to be done and methods of operation. *R. R. Gazette*, Sept. 14, 1888.
- , *Manchester Ship, Plant and Machinery.* By L. B. Wells, before the Bath meeting British Association. Gives a brief description of the principal machinery now in use on the Manchester Ship Canal. *Engineer*, Sept. 21, 1888.
- , *Nearaguna, Location of.* 1888. Gives maps showing results of the survey of the

- Nicaragua Canal during 1888, with full description of the work to be done. *Engin. News*, July 14, 1888.
- Canal, Nicaragua, Recent Surveys of.** By R. E. Perry, before the American Association for the Advancement of Science at Cleveland. Gives details of the surveys and their results. Abstracted in *Engr. News*, Aug. 13, 1888.
- , *Panama.* An abstract of an article in *Le Genie Civil*, giving profile of the proposed canal, with locks. *Engin. News*, Feb. 11, 1883.
- , *Panama, Actual Status of the.* Gives a carefully prepared article, with official profile and cuts from photographs, showing the actual condition of the work. *Engr. News*, June 2, *et seq.*, 1888.
- , *Panama, and its Rivals.* By J. S. Jeans, before the Society of Arts. Gives a brief review of the historical, engineering and commercial aspects of the Panama and Nicaragua canals. *Jour. Soc. Arts*, April 6, 1888.
- , *Panama in 1887.* By Lieut. C. C. Rogers, before the American Society of Civil Engineers. Gives details of the condition of the canal as seen during an inspection trip of nearly three weeks during March and April, 1887. Abstracted *Engin. and Build. Rec.*, Jan. 28, 1888.
- , *Panama, Plant and Machinery of the.* By Wm. P. Williams, before the Annual Convention of the American Society of Civil Engineers. Gives results of investigation of the methods and plant used on the Panama Canal. *Engr. News*, Aug. 18, 1888.
- , *Panama, Proposed Locks on the.* Gives a description, with general view, of the proposed locks on the Panama Canal. There are to be four locks, two of 8 m. and two of 11 m. lift on the Atlantic side, and three of 11 m. and one of 8 m. lift on the Pacific side. They are to be 18 by 18 m. *Le Genie Civil*, Feb. 18, 1888; *Engr. News*, March 10, 1888; *Engr. and Build. Rec.*, March 10, 1888; *Sci. Am. Supple.*, March 31, 1888.
- , *Panama, Work on the.* Gives a good statement of what has been done up to the present time. Illustrated. *Sci. Am. Supple.*, March 10, 1888.
- , *Tancarville, France.* Gives brief description of the canal being constructed between Havre and the Seine. *Sci. Am. Supple.*, Sept. 15, 1888.
- , *and Inland Navigation.* By W. J. C. Moens, before the Society of Arts Canal Conference. Gives much information relative to inland navigation in France, Belgium and Holland. *Jour. Soc. Arts*, June 8, 1888.
- , *Improvement of, Communication.* By Sam. Lloyd, before the Canal Conference of the Society of Arts. *Jour. Soc. Arts*, July 8, 1888.
- , *Improvement of, between London and Birmingham.* By Henry J. Marten. Gives details of the methods proposed for improving the efficiency and economy of the canals between London and Birmingham. *Jour. Soc. Arts*, June 1, 1888.
- , *Laws of.* By A. B. Kempe, before the Society of Arts Canal Conference. Object of the paper is to give a concise statement of the existing laws relating to canals in England. *Jour. Soc. Arts*, July 8, 1888.
- , *and Inland Navigation National Works.* By Gen. Randall, before the Society of Arts Canal Conference. Advocates the control of canals by the Government as national works. *Jour. Soc. Arts*, June 1, 1888.
- , *and Railroads, Transport by.* By G. Lester, before the Society of Arts Canal Conference. *Jour. Soc. Arts*, June 1, 1888.
- , *Great Britain.* By M. B. Cotsworth, before the Society of Arts Canal Conference. Gives the history, use and progress of canal and river navigation in England and Ireland. *Jour. Soc. Arts*, May 25, 1888.
- , *Inland Transportation in the 19th Century.* By F. R. Conder, before the Society of Arts Canal Conference. Discusses transportation in England by land and water, and shows how the canals have been taken in hand by the railroad at a loss. *Jour. Soc. Arts*, June 1, 1888.
- , See Inland Navigation.
- , *Maintenance of.* By G. R. Jebb, before the Society of Arts Canal Conference. Discusses the work of a canal, method of maintaining them, with remarks on the special difficulties to be overcome in mining districts. *Jour. Soc. Arts*, May 25, 1888.
- , *Waterway between Lake Michigan and Illinois River, by way of the Illinois River.* By R. E. McMath, before the Engineers' Club of St. Louis. Discusses the proposed waterway from a St. Louis point of view in respect to its physical,

- sanitary, economical and political consequences. *Jour. Assoc. Engin. Soc.*, August, 1888, Vol. VII., pp. 313-329.
- Canal Conference. Society of Arts.** At a conference recently held under the auspices of the Society of Arts, fifteen papers on canals and inland navigation were presented. They cover the use, history, progress and present condition of canals, their influence on railroads, and a comparison of the costs of traffic on each. *Jour. Soc. Arts*, May 28, *et seq.*, 1888.
- Canal Engineering.** By L. F. Vernon-Harcourt, before the Society of Arts Canal Conference. Treats of the past, future aims and the prospects of canal engineering in the future. *Jour. Soc. Arts*, May 25, 1888.
- Canal Lift, Fontinettes, France.** Gives a discussion on canal lifts *vs.* locks, and a description, with view, of the hydraulic lift at Fontinettes, France. *R. R. Gazette*, Sept. 21, 1888; *Engr. & Mining Jour.*, Sept. 29, 1888.
- Car, Coal, 60,000 lbs. Capacity.** Gives drawings of a 60,000 lbs. capacity coal car for the Georgia Pacific Railroad. *Nat. Car and Loco. Builder*, June, 1888.
- , **Standard 50,000 lbs.** Gives detailed drawing and specification of a standard 50,000 lbs. box car, for the Minneapolis, Sault Ste. Marie & Atlantic Railroad. *Master Mechanic*, November, 1888.
- , **Standard 50,000-lb. Freight.** Gives brief description with drawings and bill of material, of the standard 50,000-lb freight car of the Lehigh Valley Railroad. *R. R. Gazette*, June 8, 1888.
- , **Standard 50,000-lb. Gondola.** Gives detailed drawing, with abstract from specification for the standard 25-ton gondola car of the Newport News & Mississippi Valley Co. *R. R. Gazette*, April 6, 1888.
- , **Twin Hopper 60,000-lb. Gondola.** Gives description, with bill of lumber and detailed drawing, with dimensions, of a twin hopper bottom gondola car having a capacity of 60,000 lbs. recently constructed for the Lehigh Valley Railroad. *R. R. Gazette*, Sept. 14, 1888.
- , **50,000-lb. Box, C., B. & Q. R. R.** Gives plan, elevation and cross-section, with full dimensions, of the 50,000-lb. box-car in use on the Chicago, Burlington & Quincy Railroad. *Master Mechanic*, October, 1888.
- , **Twenty-five Ton Iron Ore.** Gives a two-page plate of detailed drawings of a twenty-five ton iron ore car used on the Swedish Railroad. *Engincer*, April 27, 1888.
- , **100,000-lb. Car, Penn. R.R.** Gives drawing, showing details of a car of 100,000 lbs. capacity, designed for carrying cables for street railroads, and built for the Pennsylvania Railroad. *R. R. Gazette*, May 11, 1888.
- Cars, Canada's Cattle.** Gives description, with plans, elevation and cross-section, of Canada's cattle cars. They are provided with hayracks, water-troughs and movable partitions. *R. R. Gazette*, March 2, 1888.
- , **Six-Wheel Trucks for Freight.** By J. M. Barr, before the March meeting of the Western Railroad Club. Discusses the use of the collarless axle, and advocates the use of six-wheel trucks for freight cars of 60,000 lbs. capacity. *Master Mechanic*, April, 1888; *R. R. Gazette*, March 23, 1888; *Nat. Car and Loco. Builder*, April, 1888.
- Car Axles, Bearings and Lubricants.** Summary of the discussion of the above subjects by the New England Railroad Club. *Railroad Gazette*, Nov. 18, 1887; also *Nat. Car and Loco. Builder*, December, 1887.
- Car Couplers.** Gives the contour lines, length of draw-bar and arrangement of dead-block for the automatic coupler, as established by the committee of the Master Car-Builders' Association. *R. R. Gazette*, April 20, 1888; *Master Mechanic*, May, 1888; *Nat. Car and Loco. Builder*, May, 1888.
- Car Heating.** A very good review of the different systems for heating cars by means of steam from the locomotive. By W. A. Smith, before the December meeting of the Western Railway Club. Illustrated by cuts of the different styles of couplings. *Mast. Mechanic*, Jan., 1888, also *Am. Engr.*, Dec. 23, 1887.
- , **Gold System.** Gives illustrated description of the Gold system adapted to the Baker heater. *Railroad Gazette*, Dec. 16, 1887.
- , **Sewall System.** By C. P. Karr. A very full description of the system, with drawings showing details, coupling, traps, etc. *Sci. Am. Sup.*, Dec. 24, 1887; *R. R. Gazette*, Jan. 20, 1888.
- , **Couplers for Steam.** Brief description, with drawing, of nearly all the different

- forms of coupling now in use for continuous heating of cars by steam from the locomotive. *R. R. Gazette*, Dec. 2, 1887; *Engineer*, Jan. 27, 1888.
- Car Heating, Couplers for Steam.** A very full discussion of the subject by the New York Railroad Club. *Master Mechanic*, May, 1888.
- in *Germany and Sweden*. Gives good description of the practice of heating cars by steam in Germany and Sweden. *Master Mechanic*, Nov., 1887.
 - , *Steam*. A paper by Prof. Lanza, before the April meeting of the New England Railroad Club. Giving details of experiments made to determine the amount of steam used in heating passenger cars, with discussion. *R. R. Gazette*, April 20, 1888; *Master Mechanic*, May, 1888; *Nat. Car and Loco. Builder*, May, 1888.
 - , *Steam*. Gives tabulated results of experiments in continuous heating, from reports collected by the Committee of the Master Car-Builders' Association. *R. R. Gazette*, June 22, 1888; *Engin. News*, June 30, 1888.
 - , *Steam on the C., M. & St. P. R. R.* Gives description and detailed drawings of the couplings of the Gibbs system of steam heating now being tested on the C., M. & St. P. R. R. *R. R. Gazette*, Jan. 13, 1888; *Engin. and Build. Rec.*, Jan. 21, 1888.
 - , *Steam, Notes on*. By W. F. Baldwin. A paper before the American Society of Mechanical Engineers. Gives experience gained while making experiments on the Long Island Railroad. *Engin. and Build. Rec.*, May 12, 1888; *Am. Eng.*, June 20, 1888; *Engin. News*, Aug. 18, 1888.
 - , *Test of the McElroy System*. Gives details of test of McElroy system of continuous heating made on the Hudson River Railroad. *R. R. Gazette*, April 6, 1888.
 - , *Winters Lesson in Steam*. By Geo. Gibbs, before the April meeting Western Railroad Club. Discusses steam heating in the light of the experience of the past winter. *Master Mechanic*, May, 1888; *Nat. Car and Loco. Builder*, May, 1888; *R. R. Gazette*, April 20, 1888.
- Car Wheels.** Three valuable papers presented to the February meeting of the New York Railroad Club, on the guarantee for car wheels, mileage of steel-tired wheels and the safety of cast-iron wheels. *Master Mechanic*, March, 1888; *R. R. Gazette*, Feb. 24, 1888.
- and *Axles. Their Relation to the Track*. A discussion by the members of the New England Railroad Club at its February meeting. Relates mainly to the relative merits of steel and cast-iron wheels. *Master Mechanic*, March, 1888; *R. R. Gazette*, Feb. 17, 1888; *Nat. Car & Loco. Build.*, March, 1888.
 - and *Tires*. By C. F. Allen, before the March meeting of the New England Railroad Club. Discusses the question of safety in the use of wheels and tires. Followed by discussion. *Master Mechanic*, April, 1888; *Nat. Car and Loco. Builder*, April, 1888; *R. R. Gazette*, March 23, 1888.
 - , *Specifications for Cast-Iron*. Gives specifications for cast-iron car wheels, as proposed by Mr. Barr before the Western Railway Club. *R. R. Gaz.*, Dec. 23, 1887; *Master Mechanic*, January, 1888.
 - , *Steel Tired and Chilled*. Extract from the report of the Massachusetts Railroad Commissioners on the Haverhill accident, showing the kind of wheels in use in Massachusetts. *R. R. Gazette*, May 11, 1888; *Nat. Car & Loco. Builder*, June 1888; *Engin. News*, May 19, 1888.
- Casting. New Process of Making Ornamental Castings.** Consists in lining the inside of the mould with carbonized lace or other textile fabric. Abstract of remarks made at the meeting of the Franklin Institute, April 20, 1887. By A. E. Outerbridge, Jr. *Journal of the Franklin Institute*, June, 1887, Vol. CXXIII., No. 738. Report of Franklin Institute Committee on same. *Journal of Franklin Institute*, November, 1887, Vol. CXXIV., No. 743.
- Cement and Mortar, Selection, Inspection and Use of.** By S. F. Burnett, before the Engineers' Club of St. Louis. Gives practical hints in regard to the selection, inspection and action of cement and sand, and the methods of mixing and using to produce a good mortar. *Jour. Assoc. Engin. Soc.*, July, 1888, Vol. VII., pp. 258-264.
- , *Compressive Strength of*. Progress Report of the American Society of Civil Engineers' Committee on the compressive strength of cements and the compression of mortar and settlement of masonry, with five plates. *Trans. Am. Soc. C. E.*, Vol. XVII. (November, 1887), pp. 213-218. Abstracted, *Prac. Inst. C. E.*, Vol. XCIII., p. 506.

- Cement, from Waste Product Lime.** By J. S. Rigby, before the Society of Chemical Industry, Liverpool University. A valuable paper on the utilization of waste lime from chemical process for the manufacture of cement. *Sci. Am. Supple.*, June 16, 1888.
- , *Hardening of.* A series of articles embodying the results obtained in the most recent and important investigation on the hardening of cements. The subject is treated from a chemical point of view. *Engineer*, Sept. 21, *et seq.*, 1888.
- , *How to Test the Strength of.* By J. Sonderieker. Gives a description of an apparatus for testing cements, and presents some of the results obtained. *Jour. Assoc. Engin. Soc.*, June, 1888, Vol. VII., pp. 207-222. Also *Trans. Am. Soc. Mech. Engrs.*, Vol. IX. (1888), pp. 172-184.
- , *Influence of Sugar upon.* By H. De B. Parsons, before the American Society of Mechanical Engineers. Gives details of tests of cements mixed with from $\frac{1}{4}$ to 2 per cent. of sugar and molasses. Molasses greatly retarded the setting, but at the end of two months the strength was rapidly increasing. With Portland cement one per cent. of sugar gave maximum strength. With Rosendale cement one-fourth per cent. gave maximum results. With large per cent. of sugar the cements were too soft to take from the molds in 48 hours. The effect appears to be mechanical. *Trans. Amer. Soc. Mech. Engrs.*, Vol. IX., pp. 286-293; *Engr. News*, Dec. 24, 1887; *Engr. and Build. Rec.*, Dec. 24, 1887; *Am. Engr.*, Jan. 18, 1888; *Engineer*, Jan. 27, 1888; *Engineering*, Jan. 23, 1888; *Mech. World*, Jan. 14, 1888.
- , *Lime and Hydraulic.* By F. W. Gibbs. Treats of the sources, composition and properties of limes and cements. *Trans. Arkansas Soc. C. E., Arch. and Surveyors*, November, 1887, pp. 38-46.
- , *Statement of the Industry.* A statement showing the extent of the industry in the United States. *Enginr. and Build. Rec.*, March 17, 1888.
- , *Portland, Improvements in the Manufacture of.* By Frederiek Ransome. A paper before the British Association, giving the latest and most advanced method of manufacture. *Engineer*, Sept. 9, 1887; *Sci. Am. Sup.*, Nov. 19, 1887.
- , *Portland, Testing.* By H. Farja, before the American Society of Civil Engineers. Gives details of the method employed by himself for a number of years; shows details of apparatus for mixing and testing cements. *Trans. Am. Soc. C. E.*, Vol. XVII. (November, 1887), pp. 218-228.
- , *Portland, Ramsome's Improvements in the Manufacture of.* By R. J. Friswell. Reprinted from the London *Engineer*, March 4, 1887. *Journal of the Franklin Institute*, June and July, 1887, Vols. CXXIII., CXXIV., Nos. 738, 739.
- , *Portland, Specifications for.* Gives specifications for the supply and delivery of Portland cement for paving portions of streets known as King's road and Pont street, in Parish of Chelsea. *Eng. and Build. Rec.*, Dec. 31, 1887.
- , *and Raw Materials from Which They are Made.* By W. H. Pettee. An elementary paper. *The Technic*, University of Michigan, 1888.
- Cement Mortar, Economy in the Composition of.** By Prof. I. O. Baker. Discusses the use of Rosendale vs. Portland cement, of lime and cement, strength of cement mortars, quantities of ingredients required and cost of mortars. *Eng. News*, March 10, 1888.
- , *for use in Public Works.* An abstract of a report by the Executive Board of the City of Rochester, N. Y., prepared by Emil Kurchling. *Engin. and Build. Rec.*, March 24, *et seq.*, 1888.
- , *Strength of.* By Prof. I. O. Baker. Gives tables showing the strength of cement mortar of various ages, compiled from a large number of experiments. *Eng. and Building Rec.*, May 5, 1888.
- Cement Tests.** By J. E. Codman before the Philadelphia Engineers' Club. Gives results of testing cement in different forms of briquettes. *Proc. Engs. Club*, Philadelphia, Dec., 1887, Vol. VI., pp. 168-172.
- , *New Croton Aqueduct.* Gives profile showing strength of cements used in the construction of the new Croton Aqueduct. *Engin. and Build. Rec.*, Aug. 18, 1888.
- Chain Cable.** Discussion of its strength, weakness, weld, steel, weight and method of reducing it without a proportional loss of strength, details of tests, etc. *Report of U. S. Board on Testing, etc.*, Vol. I., 1881, pp. 149-210.
- Chart.** *The Pilot Chart of the North Atlantic Ocean.* Lecture before the Franklin

- Institute, by Everett Hayden, of the United States Hydrographic Office. Presents a copy of the pilot chart for March, 1888, and interesting description of it. *Journal of the Franklin Institute*, April and May, 1888.
- Chimney.** Gives notes on the construction of a large chimney, being an iron frame lined with brick. *Sci. Am. Supple.*, Dec. 10, 1887. *Engineer*, Jan. 6, 1887.
- Chimney Shafts, Stability of.** By R. J. Hutton before the Society of Engineers. Proposes to point out some errors which have crept into the theory of the stability of chimneys, and to offer some considerations as to the economical application of the theory in practical designing. *Trans. Soc. Engs.*, 1888, pp. 150-184.
- Civil Engineers, The Education of.** By Thomas C. Clarke. With discussion. *Trans. Am. Soc. C. E.*, Vol. III. (1874), pp. 255-266.
- Coal, Conflagration at Kidder's Slope.** By Martin Coryell. Gives details of the conflagration in the mines and the methods adopted to put it out. *Trans. Am. Soc. C. E.*, Vol. III., pp. 147-154.
- , *How to Analyze.* An article describing the methods for the determination of the various constituents in coal which are considered best. *Engineer*, April 20, 1888.
- Coast Defenses of the United States** A summary of the reports to the Secretary of War, of General Duane, Chief of the Engineer Corps, and General Benet, Chief of Ordnance for the army. *The Railroad and Engineering Journal*, December, 1887.
- Coke Ovens, Bauer's.** Describes a group of ovens so arranged that they can be worked continuously with or without condensing apparatus. *Engineering*, Nov. 11, 1887. *Engineer*, Jan. 20, 1888.
- Combustion** A good article for practical men. *Engineer*, Aug. 19, 1887.
- , *Natural and Forced Draught.* By W. G. Spence before the Northeast Coast Institution. A valuable paper giving the results of experiments with forced and natural draughts. *Engineering*, Feb. 10, et seq., 1888. An editorial on the above paper, *Engineer*, Feb. 10, 1888, and the article Feb. 17, 1888.
- , *Heat of.* By R. H. Buel. Treats of the heating powers of fuels as compared with that obtained from the results of chemical analysis. Gives tables of experiments on the heat of combustion of various compounds and coals. *R. R. Gazette*, July 27, 1888.
- Columns, Z-iron, Experiments on.** By C. L. Strobel before the American Society of Civil Engineers. Gives details of the testing of 15 columns made of four "Z"-shaped iron bars. 5 plates. *Trans. Am. Soc. C. E.*, Vol. XVIII., April, 1888, pp. 103-118. Abstracted *R. R. Gazette*, July 13, and *Engin. and Build. Rec.*, Dec. 3, 1887.
- Compression Members, Strength of.** By J. G. Dagron before the annual convention of the American Society of Civil Engineers, 1887. Gives the results of the testing of eight full-size compression members made of the steel used in the B. & O. bridge over the Susquehanna River. *R. R. Gaz.*, Jan. 6, 1888.
- Concrete.** By John Lundie. Gives notes on the selection of material, mixing and depositing concrete in place. *Jour. Assoc. Eng. Soc.*, December, 1887, Vol. VI., pp. 437-440. *Sci. Am. Supple.*, April 28, 1888. *Mechanical World*, May 12 and 19, 1888.
- , *and Iron to Resist Transverse Strains.* By G. W. Percy before the Technical Society of the Pacific Coast. Gives details of experiments made on compound iron and concrete beams. *Engin. News*, Sept. 8, 1888.
- , *Effect of Low Temperature on.* By P. M. Bruner before the Engineers' Club of St. Louis. Discusses the effect of low temperature on Portland cement concrete. *Jour. Assoc. Engin. Soc.*, April, 1888.
- , *in Sea Water.* An abstract from the report of P. J. Messent to the Aberdeen Harbor Board. Gives as a cause for the failure of some of the concrete work at the Aberdeen Graving dock, injudicious specification for the cement or improper method of mixing or using it. *Engineering*, Jan. 28, 1888.
- , *Mixing and Handling.* Abstract from a paper by W. T. Learned before the New England Water-Works Association. Gives details of the methods employed at the Ashland Basin No. 4, Boston Water-Works. *Eng. News*, Dec. 24, 1887.
- Contour Lines.** By B. Feind. *Jour. Assoc. Engr. Soc.*, Vol. VII., pp. 89-92. (March, 1888.)

- Contract, Standard Building.** Gives text of a standard building contract, the adoption of which is advised by the Committee of Conference of the American Institute of Architects, the Western Association of Architects and the National Association of Builders. *Engin. & Build. Rec.*, Sept. 15, 1888.
- Copper, Analysis of.** By A. A. Blair. A paper giving the methods used for the analysis of copper. *Report of Board on Testing, etc.*, 1881, Vol. I, pp. 247-266.
- , *Influence on Steel.* See Steel.
- Covered Way, Glasgow City and District Railroad.** By W. S. Wilson, before the Institution of Civil Engineers. Gives details of the construction of a covered way of which 2,600 yards were in tunnel. *Proc. Inst. C. E.*, Vol. XCII, pp. 288-291; *Engin. & Build. Rec.*, June 23, 1888.
- Crane, "Goliath," Twelve Ton Steam.** Gives a two-page plate showing details of a twelve-ton steam traveling crane. It has a span of 60 feet, and a clear height of 28 feet. *Engineering*, Jan. 13, 1888.
- , *Traveling.* Gives a description, with full details, of a six-ton universal traveling crane for the erection of the Union Elevated Railroad, Brooklyn. *San. Engr.*, Dec. 17, 1887.
- , *Traveling.* An illustrated description of a traveling crane, 50 feet span, to lift three tons. *Engineer*, Sept. 9, 1887.
- Cranes.** Drawings of a twenty-five-ton wharf crane and a three-ton locomotive crane in *Engineer*, April 6, 1888.
- , *Water, for Indian Railroads.* Gives brief description and full detailed drawing of water cranes to be used on the Indian State railways. *Engineer*, Oct. 7, 1887.
- Croton Aqueduct.** See Aqueduct.
- Culvert, Railroad.** By E. A. Hill. Gives details of the building of a culvert for the drainage of about 1,600 acres of land; shows plans, cost, etc. *Report Ill. Soc. Engrs. and Surveyors*, 1888, pp. 28-42. *R. R. Gazette*, May 25, 1888. A continuation of the above discussion by Mr. Hill in *R. R. Gazette*, Nov. 2, 1888.
- Culverts, Water-Way for.** By A. M. Talbot. Discusses the determination of water-way for bridges and culverts, proposes a new formula. *Selected Papers C. E. Club, Univ. of Ill.*, 1887-8, pp. 14-22.
- Dam, Athens, Ga.** See Reservoir.
- , *Gileppe.* By A. Marichal. Gives a brief description of the curved masonry dam near Verviers, Belgium. Illustrated. *Proc. Engr. Club, Philadelphia*, Vol. VI., pp. 243-246.
- , *Mill River, Failure of the.* Gives report of a committee appointed to report upon the failure of a dam on Mill River, at Williamsburg, Mass. *Trans. Am. Soc. C. E.*, Vol. III., pp. 118-122.
- , *Potomac River, Washington, D. C.* By S. H. Chittenden, before the American Society of Civil Engineers. Gives description of the work of constructing a dam across the Potomac River for increasing the water supply of Washington, D. C. *Trans. Am. Soc. C. E.*, Vol. XVIII., February, 1888, pp. 50-59.
- , *Quaker Bridge.* Gives an abstract from the report of a Board of Experts on the Quaker Bridge dam. *R. R. Gazette*, Oct. 12, 1888.
- , *Quaker Bridge.* Gives full text of the report of the Board of Experts on the plans of Quaker Bridge dam. *Engr. News*, Nov. 3, 1888.
- , *Quaker Bridge, History of the.* By E. E. R. Tratman. Gives a good review of early history of Quaker Bridge dam and the reasons for its adoption. Illustrated by maps, etc., from the Report of the Aqueduct Commissioner. *Engineer*, Jan. 27, 1888.
- , *Quaker Bridge. Plan formation of.* By A. Marichal before the Philadelphia Engineers' Club. Discusses the question whether the dams should be built with a curved or straight line and advocates the former. *Am. Engr.*, Jan. 18, 1888.
- , *Sweetwater.* By J. D. Schuyler, before the American Society of Civil Engineers. Gives details of the construction of the Sweetwater dam, San Diego, Cal. *Engr. News*, Oct. 27, 1888.
- , *Walnut Grove.* Gives views, sketch plan and details of construction of the Walnut Grove "rock fill" dam, near Prescott, Ariz. *Engr. News*, Oct. 20, 1888.
- , *Masonry.* By J. W. Hill. A paper before the American Society of Civil Engineers. Gives description of the masonry dam at Eden Reservoir, Cincinnati, and shows the methods of computation used, with discussion and three plates. *Trans. Am. Soc. C. E.*, Vol. XVI., pp. 261-282, June, 1887.

- Dam, Masonry, Memoir of the Construction of.** By J. J. R. Crocs. Gives details of the construction of a masonry dam on a branch of the Croton River, in Putnam County, N. Y., by the Croton Aqueduct Board. *Trans. Am. Soc. C. E.*, Vol. III. (1874), pp. 337-367.
- , *High Masonry.* A valuable synopsis of research on high masonry dams made by A. Fteley, for the Chief Engineer of the Croton Aqueduct for the purpose of determining the form, dimensions, etc., of the proposed Quaker Bridge dam. Reprinted from the Report to the Aqueduct Commission in *Engin. News*, Feb. 4 and 11, 1888.
- , *High Masonry, Profile of.* By Isaac Morley. Derives a formula for determining the profiles of high masonry dams and discusses its application. *Engin. News*, Aug. 11, 1888.
- , *High Masonry, Theory of.* A reprint of the report of Mr. B. S. Church to the Aqueduct Commission on the design of the Quaker Bridge dam. Gives a comparison of all of the great masonry dams of the world, with plates of cross-sections and plans of the same; also tables of data, etc. A valuable article. *Engin. News*, Jan. 7 and 14, 1887; *Engineer*, March 20, 1888.
- , *Rock Fill.* An editorial discussing the use of rock fill dams. *Engin. News*, July 28, 1888.
- Design, Elements of Architectural.** A course of four lectures, by B. H. Statham, under the auspices of the Society of Arts. Treats of architectural decoration functional and applied; influence of roofing in; influence of the constructive principles of the beam and arch; mouldings, carvings, etc. *Jour. Soc. of Arts*, Dec. 23 and 30, 1887, Jan. 6, 1888; *Eng. and Build. Rec.*, Jan. 21, et seq., 1888.
- Disinfection** Describes the machines used for disinfecting clothing, bedding, etc., by means of hot air and steam, acting separately and in combination. *Engineer*, May 11, et seq., 1888; *Sci. Am. Supple.*, June 30, 1888.
- Disinfectors, Aero Steam.** A disinfectors in which all articles are subject to a moist heat of at least 213° Fah. *Engineer*, July 29, 1887.
- Dock, Alexandra, Hull.** By A. C. Hurtzig before the Institution of Civil Engineers. Gives details of the construction of the Alexandra Dock, 1881-5. The work included a dock of 46½ acres, two miles of dock wall, two graving docks, a lock 550 × 85 feet; embankment, 40 feet high and 6,000 feet long, and dredging an artificial channel. *Proc. Institute C. E.*, Vol. XCII., pp. 144-186. Abstracted *Engineering*, Feb. 10, 1888. Abstracted *Mech. World*, Feb. 18, 1888. Abstracted *Engineer*, March 2, 1888.
- , *Esquimalt.* Gives description of the new dock at Esquimalt, British Columbia, with two two-paged plates showing plans and details of the work. The dock is 451 feet long, 65 feet wide at the entrance, and has 27 feet of water on the sills. *Engineering*, July 20 and 27, 1888.
- , *Dry, Havre.* Full description, with plan, transverse section and views of the work of the large dry-dock being built at Havre, France. *Le Genie Civil*, Oct. 29, 1887; *San. Engr.*, Dec. 3, 1887.
- , *Hydraulic Lift, Bombay.* Brief description of the hydraulic lift dock at Bombay. It is the largest hydraulic structure in the world; is 350 ft. long, 88 ft. clear width, and docks vessels drawing 30 ft. *Engineering*, Nov. 25, 1887.
- , *Preston and River Ribble.* Gives history of the work of constructing a 40 acre dock at Preston, Eng., and the improvement of the river Ribble. *Engineer*, Sept. 30, 1887.
- , *Pontoons and Floating.* By Alex. Taylor, before the northeast coast Institution of Engineers and Shipbuilders. Gives approved practice for pontoons and floating docks. *Sci. Am. Supple.*, July 7, 1888.
- Drainage, Land.** A paper by E. B. Opdyck, on the construction, comparative cost and efficiency of tile drains and open ditches. *Rpt. Ohio Soc. Surv. and Engrs.*, 1888, pp. 148-155.
- , *Newhaven.* Brief description, with details, of the drainage work at the Port Newhaven, Eng. *Engineer*, July 29, 1887.
- Drainage Tables.** By G. H. Johnson. Gives tables showing the diameters of circular pipes of given length which will discharge given volumes of water per second under a given head. *Eng. News*, May 5 and 12, 1888.
- Draw-Bridge, Milwaukee.** Description of a 203-foot span double-track draw-bridge at Milwaukee. Cuts showing details. *San. Engr.*, Nov. 26, 1887.

- Draw-Bridges.** By Clemens Herschel. Treats on the principles of construction of and the calculation of the strains in revolving draw-bridges having two spans as openings and built as continuous girders, more especially as continuous panel girders. *Trans. Am. Soc. C. E.*, Vol. III. (1874), pp. 395-448.
- , See Bridge.
- Draw-Spans and their Turn-Tables.** By C. Shaler Smith. A paper for "non-specialists," showing method of computing the strains; also, gives table of draw-bridge tests to obtain co-efficient of rolling friction. *Trans. Am. Soc. C. E.*, Vol. III., pp. 129-141.
- Drawings, Cyanotype Process of Reproducing.** Gives notes compiled in the Photographic Office Survey of India Department, Calcutta, on the positive cyanotype process of reproducing drawings with dark lines on a clear ground. *Indian Engineering*, Aug. 4, 1888.
- , **Duplication of.** By J. M. Bradford. Describes the "blue prints" method, with formula. *Rept. Ohio Soc. Surv. and Engrs.*, 1888, pp. 250-261.
- Dredge, Double Ladder, Swansea Harbor Trust.** Gives brief description, with two-paged plate, showing plan, sectional elevation and sections, of a double ladder dredge recently constructed for the Swansea Harbor Trust. Dimensions, 150 × 41, with 12 hold; capacity 900 tons per hour from a depth of 38 feet. *Engineering*, July 13, 1888.
- , **Ejector**, using compressed air as power to set column of water in motion. *Annales des P. & C.*, June, 1888.
- , **Rock, Suez Canal.** An illustrated description of the sub-aqueous rock dredger "Dérocheuse," built for the Suez Canal. Its dimensions are 180 × 40 × 12 ft. It has ten chisel bars 42 ft. long, weighing four tons each, and dredging machinery to remove the broken rock. Its capacity is about 40 tons per hour. *Engineer*, March 9, 1888.
- Drilling, Relative Economy of Hand and Machine.** By W. A. Wheeler. Gives a valuable comparison of the cost of hand and machine work from a purely economical standpoint. Shows there is but little difference in the cost. *Jour. Assoc. Engr. Soc.*, February, 1888.
- Driven Wells as a Source of Water Supply for Cities.** By Albert F. Noyes. A valuable contribution to the subject, giving many important facts and generalizations. *Jour. New Eng. W. Works Assoc.*, June, 1887.
- Dynamo, Eickemeyer's.** A new departure in dynamo construction, presenting apparently some marked advantages. The field coils surround the armature, and a new and ingenious method of winding the latter is described. *Electrical Engineer*, March, 1888; *Tel. Jour. and Elec. Rev.*, March 23, 1888.
- , **Mordey's Alternating Current.** Gives an illustrated description of Mordey's new alternating current dynamo. It has fixed armatures and revolving magnets. *Tel. Jour. and Elec. Rev.*, June 1, 1888; *Sci. Am. Supple.*, July 21, 1888.
- Dynamo Machines, A Synthetic Study of.** A series of articles giving a full synthetic study of dynamo machines, including a good exposition of induction. *T. J. and Elec. Rev.*, Aug. 3, 1888.
- Dynamo-Electric and Electro-Dynamo Machinery, Design and Construction of.** Read before the Engineers' Club of St. Louis, Feb. 16, 1887, by Dr. Wellington Adams. Applies the formulæ of Kapp to the design of an efficient dynamo. *The Electrician and Electrical Engineer*, Dec., 1887.
- Dynamos and Motors, Designing and Calculating.** The most practical method of designing and proportioning dynamos yet published. Francis R. Crocker. *Electrical World*, April 28, 1888.
- Dynamometer, French Transmission.** Gives a description of a dynamometer constructed and used to determine the efficiency of a plant for the transmission of power by electricity. *Engineer*, Feb. 17, 1888.
- Earthwork, Filling South Boston Flats.** By F. W. Hodgdon. Gives details of the methods employed by the Commonwealth of Massachusetts to fill 120 acres of South Boston Flats from two feet below to thirteen feet above mean low water. *Jour. Assoc. Eng. Soc.*, January, 1888, pp. 5-9.
- , **Formula for.** Gives a new formula, derived from the prismoidal formulæ, for computing railroad earthwork. It also has a graphical representation. *Engin. News*, July 28, 1888.
- Economy of Structures, Comparison of the.** By Prof. G. F. Swain, before the New

- England Water-Works Association. Discusses the proper method of comparing the economy of structures of different classes. *Jour. N. Eng. W.-Works Assoc.*, March, 1888, Vol. II., pp. 31-34.
- Electric Balance, Thomson Composite.** By Thomas Gray. Full description of Sir Wm. Thomson's new balance, available as volt, ampere, or watt-meter. *Sci. Am. Supple.*, July 14, 1888.
- Electric Batteries. The Possibilities and Limitations of Chemical Generators of Electricity.** A paper read before the Am. Inst. of Electrical Engineers, May 16, 1888, by Francis B. Crocker. Shows what can be expected of any given combination of materials, and gives table of the cost per horse-power per hour of voltaic battery energy, with different materials. *Electrical World*, May 26, 1888; *Electrical Engineer*, June, 1888.
- Electric Furnaces.** By E. J. Houston. Describes some of the early electric furnaces. *Tel. Jour. and Elec. Rev.*, April 6, 1888.
- Electrical Lighting. Applied upon the Suez Canal.** By R. Percy Sellon before the Mechanical Science Section of the British Association for the Advancement of Science. Describes the use of the electric light on the Suez Canal, and gives text of the regulation issued by the canal company. *T. J. and Elec. Review*, Sept. 14, 1888.
- Electric Lighting. Cost of Arc Lighting.** A paper read by C. M. Keller before the Western Gas Association, giving the running expenses for a number of cases for Thomson-Houston and American arc lights. *Progressive Age*, June, 1888.
- Electric Lighting. Efficiency of Incandescent Lamps.** By W. E. Ayrton and J. Perry. Before the Physical Society of London. Treats of the efficiency of incandescent lamps with direct and alternating currents. The mean of 75 experiments gave same results for both. *Tel. Jour. & Elec. Rev.*, June 1, 1888.
- *in America.* By Prof. Geo. Forbes, before the Mechanical Science Section of the British Association for the Advancement of Science. Compares the present state of the central system of lighting with its condition four years ago. Also compares the state of the system in the United States with that of England. *Tel. Jour. and Elec. Review*, Sept. 14, 1888.
- , *Independent Engines.* A paper before the American National Electric Light Association, by William L. Church, discussing the advantages of independent engines over the system of concentrated power for incandescent lighting. *Tel. Jour. and Elec. Rev.*, April 13, 1888.
- *Maximum Efficiency of Incandescent Lamps.* A paper read before the American Institute of Electrical Engineers, April 10, 1888, by John W. Howell. A valuable contribution to electric lighting literature. Illustrates how to determine at what candle-power it is most economical to operate any given lamp, and determines for a particular Edison lamp that it is working at its maximum efficiency when the cost of the lamp is 15 per cent. of the total cost of operation. *Electrical World*, April 14, 1888.
- Electric Lighting Tower System.** Describes the system in practice at Detroit. Gives detailed drawing of the 150-foot towers, with dimensions. *Eng. and Build. Rec.*, Dec. 24, 1887.
- , *Underground Wires of.* By W. W. Leggett, before the National Electric Light Association. Discusses the difficulties of putting the arc light wires underground. *Tel. Jour. and Elec. Rev.*, April 6, 1888.
- , *of Passenger Trains.* Paper read before the American Institute of Electrical Engineers at its June meeting in New York, by G. W. Blodgett, Electrician of the Boston & Albany Railroad. Describes various methods, especially that in use on the B. & A. Railroad, employing storage batteries. *The Railroad and Engineering Journal*, Oct., 1887.
- , *Validity of the Incandescent Patent.* Gives text of the decision of the High Court of Justice, England, in the matter of the Edison & Swan United Electric Light Co. vs. Holland and others. *Eng. and Build. Rec.*, Aug. 4, 1888.
- *Installation Breakdowns.* By R. F. Jones, before the old Students' Association, Finsbury Technical School. Gives a classification of breakdowns in electric plants; then gives actual cases, with their symptoms, causes and cures. *Tel. Jour. & Elec. Rev.*, June 22, 1888.
- *Installation, "Kaiser Gallerie," Berlin.* Gives description of the plant at the

- King's Gallery, Berlin, with a two-paged plate showing plan and section of engine room. *Engineer*, Sept. 21, 1888.
- Electric Lights for the New Cruisers.** Paper read before the National Electric Light Association by Lieut. J. B. Murdock, U. S. N., presenting in a general way the views of the Bureau of Ordnance of the Navy Department on the peculiar conditions to be met in the lighting of ships, and the best methods of meeting them. *The Railroad and Engineering Journal*, Oct., 1887.
- Electric Meter, Thomson's.** An electric current meter for continuous or alternating currents, invented by Prof. Elihu Thomson. The vaporization of a volatile liquid by the heat of the current is employed to effect a reciprocating motion, which is registered by a train. *Electrical World*, April 28, 1888.
- , *Meter.* A practical current meter, the invention of Prof. George Forbes, described by him before the American Institute of Electrical Engineers, Oct. 11, 1887. Illustrated. With interesting discussion. The meter is very simple, and works on the principle of a smoke jack by a current of heated air rising from a coil. *The Electrician and Electrical Engineer*, Nov., 1887.
- Electric Motors, Designing.** By T. Waku. Discusses the best practical method of proportioning and the proper winding of motors, and gives practical experience in the construction of special motors. *Mech. World*, Feb. 18, 1888; *T. J. and Elec. Rev.*, Feb. 24, 1888.
- , *An exposition of the principles with especial reference to the Sprague system.* Presented to the U. S. Naval Institute, May 16, 1887, by F. J. Sprague. *Proceedings of the U. S. Naval Institute*, Vol. XIII., No. 3.
- , *Charges for Services.* A paper presented to the Electric Light Convention, showing that there is a general average controlling the use of machinery which is safe for power companies to follow in making charges for electric motors. *Sci. Am. Supple.*, Sept. 22, 1888.
- , *Notes on the Governing of.* By W. E. Ayerton and J. Perry, before the Physical Society. *T. J. & Elec. Review*, July 20, 1888.
- , *for Alternating Currents.* Paper read before the American Institute of Electrical Engineers, May 16, 1888. By Nikola Tesla. A new principle in electric motors, apparently the most practical scheme yet proposed for alternating current work; also some remarks on transformers. *Electrical World*, June 2, 1888; *Electrical Engineer*, June, 1888; *Tel. Jour. & Elec. Review*, June 15 and 22, 1888.
- , *How to make a Simple.* By G. M. Hopkins. Gives full instructions by which a motor can be made with ordinary tools. Illustrated. *Sci. Am. Supple.*, April 14, 1888; *Tel. Jour. & Elec. Rev.*, April 13, 1888.
- , See Dynamos.
- Electric Road in Hamburg.** By J. L. Huber, before the Institution of Civil Engineers. Gives details of the trial trips made on the Hamburg electric road with the Julien system. *Proc. Inst. C. E.*, Vol. XCII., pp. 304-311.
- Electric Railroads.** By J. T. Sprague, before the American Institute of Electrical Engineers. A valuable and exhaustive paper, covering the whole field of electric railroads; also contains a description of the Richmond line, with detailed account of daily working expenses. Abstracted *T. J. and Elec. Rev.*, August 3, 1888. *R. R. Gazette*, Nov. 2, 1888.
- Electric Railroad, St. Paul.** Gives a brief sketch, with drawing, of an electric railroad in St. Paul. The cars are suspended from an overhead rail. *Engin. and Build. Rec.*, Aug. 4, 1888.
- , *Street Cars, Methods of Gearing for.* Paper read before the American Institute of Electrical Engineers, Sept. 20, 1887, by A. Reckenzaun, C. E. Compares different methods of gearing in use, and advocates the use of worm-gearing. *The Electrical World*, Oct. 1, 1887.
- Electric Wave and Phase Indicator,** for alternating and undulatory currents. A diaphragm is made to move a light mirror in harmony with the current vibrations, and the form of the waves is indicated by the movement of a spot of light. In this way photographs of the wave forms may be made. Elihu Thomson in *The Electrical World*, Jan. 28, 1888.
- Electrical Measuring Instruments.** *Sir Wm. Thomson's New.* A new system of standard electrical measuring instruments in which the electrical force is balanced by gravity. *Electrical World*, Feb. 25, 1888.
- Electrical Resistance, Compensated Standards of.** Paper read before the Ameri-

- can Institute of Electrical Engineers, May 16, 1888. By Edward L. Nichols. Describes a method of making a standard of resistance unaffected by temperature, by combining copper and carbon. *Electrical Engineer*, June, 1888. *Electrical World*, June 9, 1888.
- Electrical Subway, New York.** Gives a good history of the Board of Electrical Control of New York City and its work. *Eng. News*, April 21, *et seq.*, 1888.
- Electrical Stresses.** By A. W. Rucker and C. V. Bays, before the Society of Telegraph Engineers and Electricians. An interesting paper on some phases of static electricity. Illustrated. *Sci. Am. Suppl.*, May 19.
- Electric Traction.** By G. de Coetlogon. An abstract of a paper in *Le Genie Civil*. Describes the methods of transmission, motive force, existing electric traction enterprises, and traction by accumulators. *Engin. News*, Aug. 18, 1888.
- Electrical Units.** A paper by Prof. F. E. Nipher, explaining the origin and meaning of the terms volt, ohm and ampere. *Jour. Assoc. Engin. Soc.*, Vol. VII., pp. 83-89 (March, 1888); *Tel. Jour. & Elec. Rev.*, April 27, 1888.
- Electric Welding.** By C. J. H. Woodbury, before the Scranton meeting of the American Society of Mechanical Engineers. Reviews the principles upon which electric welding is based, describes the apparatus used and then considers its practical applications. *Amer. Eng.*, Oct. 17, 1888; *R. R. Gaz.*, Nov. 2, 1888.
- Electrical Welding.** Abstract of a paper by Professor Ruhlman, giving an account of the process and the description of the advantages which are claimed as resulting from it. Illustrated. *Engineering*, Jan. 27, 1888; *Sci. Am. Supple.*, March 3, 1888; *Eng. & Build. Rec.*, March 31, 1888.
- , *Practical Application of.* By O. K. Stewart, before the Boston Electric Club. Discusses the present aspect of the question and tells what is now being done in practical work. *Sci. Am. Supple.*, July 21, 1888.
- , *by Means of the Arc.* An illustrated description of the method and apparatus. *Electrical World*, Feb. 25, 1888.
- Electricity Applied to Engineering.** By Wm. Geipel before the Institution of Mechanical Engineers. An exhaustive view of the practical application of electricity to industrial uses. Treats of the electrical transmission and distribution of power, of locomotion, lighting and metallurgy. *Engineering*, Oct. 24; *Sci. Am. Supple.*, March 10, 1888.
- *as a Motive Power.* By Wm. Wharton, before the Philadelphia Street Railway Convention. Gives a full review of electricity as applied to the propulsion of street cars, with figures of expense and practical details. *Sci. Am. Suppl.*, Dec. 3, 1887.
- Electricity. Construction of Plant.** By Elihu Thomson, before the American National Electric Light Association. Discusses the insulation and installation of wires and the construction of plants. *Tel. Jour. & Elec. Rev.*, March 23, 1888.
- *Current to Produce Adhesion.* By E. E. Ries. Gives results of experimental examination of the electric current as a means of increasing the tractive adhesion of railway motors and rolling contacts. *Sci. Am. Suppl.*, Dec. 10, 1887.
- , *Distribution of.* By J. K. D. Mackenzie before the Society of Telegraph Engineers and Electricians. Discusses the use of secondary generators as transformers for the distribution of electricity. Gives points on the practical working of the system. *Elec. Rev.*, Feb. 17, *et seq.*, 1888.
- *in Mills, Various Uses for.* By C. J. H. Woodbury. Mentions briefly various applications of electricity to purposes other than lighting. *The Electrician and Electrical Engineer*, November and December, 1887.
- , *Influence Machines.* By James Wimshurst before the London Royal Institution, giving a full account of the recent forms of generators of static electricity. Illustrated. *Tel. Jour. & Elec. Rev.*, May 26, 1888.
- , *Its Production Direct from Fuel by Edison's Pyromagnetic Dynamo.* Paper read before the American Association for the Advancement of Science, New York. By Thomas A. Edison. *The Railroad and Engineering Journal*, October, 1887.
- , *Kirchoff's Laws and their application.* By E. C. Rimington. Gives a good description of the application of Kirchoff's laws to the finding of currents in a network of conductors. Illustrated with many diagrams. *Tel. Jour. & Elec. Rev.*, March 2, *et seq.*, 1888.
- , *Measurement of Supply.* By W. Lowrie before the Bath meeting of the

- British Association. Describes the system of measurement of house-to-house supply of electricity in use in Eastborne, Eng. *Tel. J. and Elec. Review*, Sept. 21, 1888.
- Electricity**, *Modern Views of*. Extracts from lectures by Dr. Oliver Lodge in London and Birmingham. Not published before. *Engineer*, Nov. 4, 1887.
- , *On Flashing Carbon Filaments at Different Temperatures*. By L. S. Powell. Gives details and results of experiments made to obtain a clearer insight of what really goes on by employing different temperatures in flashing. *Tel. Jour. and Elec. Rev.*, May 4, *et seq.*, 1888.
- , *Projection of Lines of Force*. By J. W. Moore. Gives an illustrated description of the use of the lantern in obtaining direct optical projections of electrodynamic lines of force and other phenomena. *Sci. Am. Supple.*, April 21 and 28, 1888.
- Electricity**, *Report of Board of Control, N. Y.* Gives an abstract of the report of the Board of Electrical Control, addressed to the Governor and Legislature of New York State. Illustrated. *Eng. and Build. Rec.*, Jan. 14, 1888.
- , See Voltmeters.
- , *Standardizing Electrical Instruments*. By A. W. Meikle, before the Physical Society of Glasgow University. Gives a description of an application of the electrolysis of copper sulphates which has been employed for standardizing purposes in the Physical Laboratory of Glasgow University for the last two years. *Tel. Jour. and Elec. Rev.*, March 23, *et seq.*, 1888.
- , *The Volt, the Ohm and the Ampère*. A mathematical exposition of the method employed in fixing the values of these units. Read before the Engineers' Club of St. Louis, by Prof. F. E. Nipher, of Washington University. *Journal of the Association of Engineering Societies*, March, 1888. *Tel. Jour. and Elec. Rev.*, April 27, 1888.
- , *Transformers vs. Accumulators*. By R. E. Crompton, before the Society of Telegraph Engineers and Electricians. A valuable paper, presenting facts and figures relating to the distribution of electricity by accumulators as transformer *vs.* transformers. Discussion. *Tel. Rev. and Elec. Rev.*, April 20, *et seq.*
- Elevated Railroad**. Gives detail of iron work on the Inter-state Rapid Transit Railroad, K. C. *Eng. News*, May 19, 1888.
- , *Berlin*. Gives a complete account of the structure, with details of construction, traffic, etc. Illustrated. *Engin. and Build. Record*, Feb. 4, *et seq.* 1888.
- Elevator**, *Most Economic*. By E. E. Magovern. Gives results of tests made on the elevators supplied by the New York Steam Company. *Steven's Indicator*, January, 1887; *San. Engr.*, Dec. 3, 1887.
- Embankment**, *Rapid Construction*. By J. A. Smith. Describes the method adopted for filling Hall street, St. Louis, in a short space of time. *Jour. Assoc. Engin. Soc.*, Vol. VII., pp. 103-106 (March, 1888). *Engin. & Build. Rec.*, March 24, 1888. *R. R. Gazette*, June 1, 1888. *Engin. News*, Aug. 18, 1888.
- , *Stability of Swamp*. By Samuel McElroy. Gives experience in dealing with embankments over swampy ground. *R. R. Gazette*, Aug. 31, 1888.
- Engine**, *Compound*. Illustrated description of an engine exhibited at the Rouen Exhibition and now in the Loubardemont flour mills. *Engineer*, July 15, 1887.
- , *Compound, at Dublin*. A short description, with a two-page plate showing plan, elevation, cross-section and valve gear of a compound condensing engine fitted with Collman's valve gear. Cylinders are cast steel, jacketed, 14 and 20 inches in diameter, 28 inches stroke; speed, 87 revolutions; pressure, 150 lbs.; horse-power, 150. *Engineering*, Feb. 3, 1888.
- , *Compound Corliss*. Gives a brief description with two-page plate and other engravings of a compound Corliss engine. Cylinders 40 × 70 in., stroke 72 in., 2,500 indicated horse-power. *Engineering*, April 16, 1888.
- , *Compound Horizontal*. Gives an illustrated description of a compound horizontal 2,000 indicated horse-power engine. Cylinders 38 and 66 in. in diameter, 6 feet stroke, pressure 95 lbs., piston speed 600 feet per minute. *Engineering*, Jan. 20, 1888; *Sci. Am. Supple.*, Feb. 25, 1888.
- , *Compound Pumping*. A two-page plate showing the engines and pumps of the Southwark and Vauxhall Water Company and other engravings, giving engine details. Engines are inverted double-cylinder compound direct-acting rotative. *Engineer*, July 22, *etc.*, 1887.

- Engine, Compound, Use of, for Manufacturing Purposes.** By Chas. S. Main, before the Scranton meeting of the American Society of Mechanical Engineers. Discusses the use of the compound engine for manufacturing purposes, the relative areas of cylinders and the regulation of pressure in the receiver. *Amer. Eng.*, Oct. 24, 1888; abstracted *R. R. Gazette*, Oct. 19, 1888.
- , **Compound Tandem.** Brief description, with two-page plate showing plan, elevation and sections of exhaust valves of a tandem compound horizontal engine, constructed at Rouen. *Engineering*, Nov. 11, *et seq.*, 1887.
- , **Compound Vertical.** Detail drawings, fully dimensioned, of all the parts of the engines for the Indian State Railway. *Engineer*, Sept. 2, *etc.*, 1887.
- , **Davey's Differential Pumping.** Brief description, with two-page plate and other engraving, showing plan, elevation and cross-sections of Davey's differential pumping engine for the Weston Water-Works. *Engineer*, Jan. 13, 1887.
- , **Gas, Atkinson.** Brief description, with indicator diagram, of the Atkinson gas engine, which gave a brake horse-power, for 20.5 cubic feet of gas. Illustrated. *Engineer*, Dec. 30, 1887.
- , **Gas, Beck's.** A report of an exhaustive series of experiments made by Prof. A. B. W. Kennedy on Beck's gas engine. Illustrated. *Engineer*, May 4, 1888. Abstracted *Engin. News*, June 9, 1888.
- , **Gas, Griffin.** Gives details of experiments with a Griffin gas engine. Showed a consumption of 18.86 cubic feet per hour per horse-power. *Engineering*, April 13, 1888; *Engineer*, May 25, *et seq.*, 1888.
- , **Gas, Sturgeon.** Brief description, with drawing, of the cylinders of the Sturgeon gas engine. *Engineer*, June 15, 1888.
- , **Hot Air, Benier's.** Description of the above engine, with plan, sectional elevations and sections. *Engineer*, Nov. 4, 1887; *Sci. Am. Supple.*, Dec. 10, 1887. *Polytechnische Journal*, Vol. CCLXVII., 1888, p. 193.; *Abst. Proc. Inst. C. E.*, Vol. XCII., pp. 488-9.
- , **Heat in the Steam.** Gives translation of the explanation of Prof. Dwelshauver-Déry's diagrams of exchange of heat between metal and steam in a steam engine. Illustrated. *Engineering*, July 27, 1888.
- , **Hargreaves Thermo-Motor.** Gives a description, with a sectional elevation, of Hargreaves thermo-motor, which, at 100 revolutions per minute, indicated 40 horse-power. It consumes 20½ lbs. of coal tar per hour. The highest available efficiency is 73 per cent. *Engineer*, Jan. 27, 1888; *Power and Steam*, March, 1888.
- , **Horizontal Corliss.** Gives two-page plate and short description of an 18 by 48 Corliss engine. *Engineering*, April 20, 1888.
- , **Petroleum Spirit.** Gives a series of interesting diagrams from a petroleum spirit engine. *Engineer*, June 15, 1888.
- , **Pumping.** Illustrated description of a new form of pumping engine for Champagne, Ill. It is a vertical compound duplex direct double-acting steam pump, with outside flanges. *Eng. News*, Nov. 26.
- , **Pumping Test of Philadelphia Water-Works.** A report by J. L. Ogden, J. E. Codman and F. T. Hally on the duty and capacity of a 20,000,000 gallons Gaskill engine at the Spring Garden pumping station, Philadelphia. Gives the method of conducting test, with calculated and observed data. The engine gave a duty of 122,522,276 foot-pounds per 100 pounds of coal. *Eng. News*, Feb. 18, 1888.
- , **Pumping, Umaria Colliery.** Gives abstract from the specification for the construction of a colliery plant in India. Illustrated. *Engineer*, Aug. 19, 1887.
- , **Riggs High Speed.** Describes a new and ingenious type of four-cylinder revolving steam engine, capable of attaining 2,000 revolutions per minute. Illustrated. *Mech. World*, Feb. 18, 1888; *Sci. Am. Supple.*, March 10, 1888.
- , **Rota.** Gives brief description of a new type of high-speed engine. *Ill. Eng.*, July 20, 1888.
- , **Steam, Applied to Bicycle and Tricycle.** A description of a small, light steam engine and boiler, invented by L. D. Copeland. *Am. Machinist*, March 3, 1888.
- , **Triple Compound.** Perspective view of a set of triple expansion engines and specifications to which they were built. *Engineer*, Aug. 26, 1887.
- , **Triple Expansion.** Gives view and brief description of the triple expansion engines of the steamer "City of New York." The cylinders are 45, 71 and 113 inches; stroke, 5 feet; indicated horse-power, 20,000 at 150 lbs. pressure. *Engineering*, Aug. 3, 1888.

- Engine, Triple Expansion.** Sectional elevation and perspective views of the triple expansion engines of the Italian cruiser "Dogali." *Engineer*, Aug. 5, 1887.
- , *Triple Expansion Non-Condensing.* Gives a description, with dimensions, of a triple expansion non-condensing engine that gives an indicated horse-power per hour for 1.45 lbs. of coal. *R. R. Gaz.*, Aug. 3, 1888; *Eng. News*, Aug. 11, 1888.
- Engines, Copper Steam Pipes for.** By W. Parker, before the Institution of Naval Architects. Gives a summary of investigations and results of experiments made to ascertain the behavior of different kinds of commercial copper under various treatments and temperatures. *Engineering*, August 3, 1888; *Am. Engr.*, Aug. 29, *et seq.*, 1888; *Sci. Am. Suppl.*, Sept. 1, 1888.
- , *Compound and Non-Condensing Steam Jackets, etc.* By Chas. E. Emery. Presents tabular statement showing the results of experiments made in 1874 on a number of steamers to ascertain the best means of securing economy of fuel. *Trans. Am. Soc. C. E.*, Vol. III. (1874), pp. 367-394.
- , *Economy Trials of the Non-Condensing.* By P. W. Williams, before the Institution of Civil Engineers. Gives details of a series of economy trials made on a triple expansion engine used as a simple, compound and triple engine. *Proc. Inst. C. E.*, Vol. XCIII., pp. 128-243; *R. R. Gazette*, April 6, 1888; *Mechanical World*, March 24, 1888; *Engineer*, April 6, 1888; *Sci. Am. Suppl.*, May 26, 1888.
- , *Efficiency of Plant.* By Prof. De Volsen Wood. A review of the recent steam engine efficiency. *Sci. Am. Suppl.*, Sept. 1, 1888.
- , *Friction of Non-Condensing.* Paper read at a meeting of the American Society of Mechanical Engineers, New York, November, 1886; by Prof. R. H. Thurston, of Cornell University. Describes experiments showing that the friction of a non-condensing engine is practically the same for all loads. *Trans. Am. Soc. of Mechanical Engineers*, Vol. VIII., 1887; *Am. Engr.*, Dec. 14, *et seq.*, 1887. A paper before the Philadelphia meeting in *Trans. Am. Soc. of Mech. Engrs.*, Vol. IX., 1888, on the same subject. *Abstracted Engin. News*, May 26, 1888.
- , *Marine, First Century of the.* By Prof. H. Dyer, before the Institution of Naval Architects. Gives a brief résumé of the chief steps in the development of the steam engine and marine navigation. *Engineer*, Sept. 21 and 28, 1888.
- , *Marine, Development of.* A series of illustrated articles with the object of describing and illustrating the marine engines in the existing ships of the British Navy, and to trace the development of the engine from the type fitted in the oldest of them to that at present being fitted in the most modern. *Engineer*, March 23, *et seq.*, 1888.
- , *Mill.* By B. H. Thwaite. A lecture before the Textile Society of Yorkshire College, Leeds, giving retrospective history of the transition in the development of the steam engine. *Engineering*, July 13, *et seq.*, 1888.
- , *New Principle in Piston Packing.* By John E. Sweet, before the Philadelphia meeting of the American Society of Mechanical Engineers. *Trans. Am. Soc. Mech. Engrs.*, Vol. IX., pp. 91-99.
- , *Proportioning of Cylinders.* By R. H. Thurston, before the American Society of Mechanical Engineers. *Trans. Am. Soc. Mech. Engrs.*, Vol. IX. (1888), pp. 360-368.
- , *Reciprocating, Dynamics of.* By Prof. M. E. Cooley. A very careful and thorough study of the forces acting on the crank pin, etc., with diagrams. *The Technic*, Univ. of Michigan, 1888.
- , *Triple Expansion.* By Wm. M. Henderson. A paper before the Franklin Institute describing Henderson's improved triple expansion engines. Claims to have the fewest possible number of parts. *Sci. Am. Suppl.*, Nov. 26, 1887.
- , *Triple Expansion for Lake Service.* By W. Miller. Gives his experience with triple expansion engines, and describes the different designs brought out. *Jour. Assoc. Engin. Soc.*, Vol. VII., pp. 75-83 (March, 1888).
- , *Triple Expansion of S. S. "Courier."* Brief description, with two-page plate, giving two perspective views of the triple expansion engines of the steamship "Courier." *Engineering*, Jan. 6, 1888.
- , *Triple Expansion of H. M. S. "Orlando" and "Undaunted."* Two two-page plates, showing vertical and horizontal sections through engine and boiler-rooms, two cross sections, and three perspective views of the triple expansion engines of the steamers "Orlando" and "Undaunted." *Engineering*, Nov. 4 and 25, 1887.

- Engines, Volatile Vapor.** By A. F. Yarrow, before the Institution of Naval Architects. Discusses the possible advantage of using highly volatile liquids in lieu of water for the purposes of propulsion. Describes a launch propelled by a volatile hydrocarbon. *Engineering*, April 9, 1888.
- Engine Trial, Newcastle.** Gives full particulars of the engines and boilers, with results of trial, tested by the Royal Agricultural Society at Newcastle, England. *Engineering*, Nov. 18, *et seq.*, 1887; *Engineer*, Nov. 19, *et seq.*, 1888.
- Engineer His Commission and His Achievements.** President C. H. Babcock's address before the American Society of Mechanical Engineers. *Trans. Am. Soc. of Mech. Engrs.*, Vol. IX. (1888), pp. 23-37.
- Engineering, Agricultural, in India.** A series of articles on irrigation, with the side issues, geological, social and financial, which must be considered in an extensive scheme. *Engineering*, April 6, *et seq.*, 1888.
- , *Review of for 1887.* A long editorial in *Engineer* for Jan. 6, 1888, gives a good review of the engineering progress and practice for the year of 1887.
- , *Estimates, Costs, Accounts, etc.* A series for young engineers showing the methods of making estimates, etc., with a discussion of the underlying principles. *Mech. World*, Jan. 6, 1887.
- Engineering Structures, Destructive Agencies in.** A series of articles discussing the agencies tending to destroy engineering structures and their remedies. *Am. Eng.*, Aug. 15, 1888.
- Estuaries, Tidal and the Bar of Mersey.** By W. H. Wheeler. Gives a general discussion of two papers read before the British Association. *Engineer*, Nov. 11, 1887.
- Excavators, Steam.** By W. L. Clements before the American Society of Mechanical Engineers. Describes the general construction of steam excavators, and then gives detail of a special machine. Abstracted, *R. R. Gazette*, May 11, 1888; also *Eng. News*, May 26 *et seq.*, 1888, and supplemented by information from other sources.
- Explosives and their Composition.** By W. C. Foster. Gives a list of the explosives most commonly used, with the composition, and references to publications in which notes may be found. *Eng. News*, June 30 *et seq.*, 1888.
- , *Composition of High.* Gives interesting list of the composition of high explosives. *Le Genie Civil*, Oct. 22, 1887; *San Engr.*, Nov. 26, 1887.
- , *Roburite.* Gives results of experiments in mining coal with roburite. *Engineer*, Oct. 28, 1887; *Sci. Am. Suppl.*, Nov. 19, 1887.
- , *A New.* Gives some of the characteristics and properties of a new explosive called Emmensite, said to better than dynamite. *Am. Engr.*, Nov. 23, 1887; *Sci. Am. Sup.*, Jan. 7, 1888.
- Extension, Elastic.** By R. H. Graham. Gives a mathematical treatment of the subject of elasticity. Considers it a form of motion and subject to the laws of velocity and acceleration. *Engineer*, Aug. 19, 1887.
- Falls of St. Anthony, Preservation of the Apron at the.** By A. Johnson, before the Engineers' Society of St. Paul. Gives description of the Falls of St. Anthony, the main work constructed for their preservation, and describes in detail the construction of a crib to protect the apron of the fall. *Jour. Assoc. Engin. Soc.*, July, 1888, Vol. VII., pp. 271-279.
- Filter, Warren Water.** Description of the Warren water filter, with plan and sections. *Eng. News*, Nov. 19, 1887.
- Filtration, Gerson's System.** Describes a process in which water is passed through sponges and pumice stone filled with insoluble tannate of iron. Gives analysis of water before and after passing the filter. *Engineering*, Nov. 18, 1887.
- , *Practical Results of Mechanical.* By W. S. Richards. A paper before the American Water-Works' Association, giving experience with Hyatt filters at the Atlanta Water-Works. *Proc. Amer. Water-Works Assoc.*, 1883, pp. 143-152. Abstracted *Engin. and Build. Rec.*, May, 1888.
- , See Water Supply.
- Firearms, Development of Automatic.** Gives a two-page plate and short description of the details of the Maxim gun. *Engineering*, Jan. 27, 1888.
- Fire Grates, Donneley for Boilers.** Gives plan, elevation and section of the Donneley fire grate, and the results of experiments with different kinds of coal. *Railroad Gaz.*, Jan. 6, 1888.
- Fires, Prevention and Extinction of.** By A. Chatterton, before the students of the

- Institution of Civil Engineers. Discusses the causes of fires, fire-proof material, fire-proof construction, internal and external appliances for extinguishing fires. *Proc. Inst. C. E.*, Vol. XCIII., pp. 437-461.
- Flexure, Resistance of Beams to.** By J. G. Barnard. An abstract from a paper on the resistance of materials, by M. Decamble, with comments. *Trans. Am. Soc. C. E.*, Vol. III., pp. 123-128.
- Flooring, Steel.** Gives description, with illustrations showing its application of Lindsay steel flooring. *Engineer*, Oct. 7, 1887; *Engr. News*, Nov. 26, 1887.
- Floor-Beam, Test of a.** By A. P. Boller, before the American Society of Civil Engineers. Gives details of the testing of a full sized wrought-iron double track floor beam. Three plates. Discussion. *Trans. Am. Soc. C. E.*, Vol. XVIII., May, 1888, pp. 119-130; *Engineer*, April 27, 1888; *Sci. Amer. Supp.*, June 2, 1888.
- Flow of Air, in Sewers.** See Sewers.
- Flow of the West Branch of the Croton River.** By J. J. R. Croes. Gives details of the rainfall and gauging of the west branch of the Croton River from 1866-72. *Trans. Am. Soc. Civ. Engrs.*, Vol. III., pp. 76-86.
- Flow of Water, New Formula for, in Pipes and Open Channels.** By E. C. Thrupp. Gives a modification of Hogan's formula, based on experiments applicable to pipes and open channels. Compares experiments with results obtained by calculation. *Engineer*, Dec. 16, 1887. Abstract in *Sci. Am. Supple.*, Feb. 11, 1888.
- , *New Formula for.* By E. C. Thrupp, before the Society of Engineers. Gives details of experiments with pipes and open channels, and shows method of deriving his new formula for the flow of water. *Trans. Soc. Engrs.*, 1888, pp. 224-264.
- Flow of Water in Mains, as Determined by Pressure Gauges.** A paper by George A. Ellis, showing how the flow in pipes may be estimated from the loss of head. *Jour. New Eng. W. Works Assoc.*, Sept., 1886.
- Flood Gates, Automatic.** Gives brief description, with cuts, of the Czvetkovics automatic flood gate. *Engineering*, July 13, 1888.
- Forests, Their Influence on Rainfall.** A paper by Prof. Geo. F. Swain, giving an able and rational discussion of the subject, and including a synopsis of the known facts relating thereto. *Jour. New Eng. W. Works Assoc.*, Vol. I., No. 3.
- Forced Draught, Closed Stakehold System.** By Thos. Soper, before the Institution of Naval Architects. Gives a discussion on the use of forced draught under boiler in the closed stakehold system. Contains the experience gained with vessels in the British Navy. *Engineer*, April 6, 1888; *Engineering*, April 6, 1888.
- , By J. R. Fothergill, before the Institution of Naval Architects. Gives the results of trials made with forced draught on the steamers "Marmora," "Dania" and "Elna." The summary shows a slight reduction in speed, with a saving of from 20 to 30 per cent. in fuel. *Engineer*, April 6, 1888; *Engineering*, April 6, 1888.
- Friction in Tooth Gearing.** By G. Lanza, before the American Society of Mechanical Engineers. Gives a mathematical investigation of friction in the involute and epicycloidal forms of gearing. *Trans. Am. Soc. Mech. Engrs.*, Vol. IX., pp. 185-228.
- , *of Collar Bearing.* Gives the third report of the research committee "On Friction" of the Institution of Mechanical Engineers. Report gives results of experiments on the friction of collar bearings, with description of apparatus. *Engineer*, May 4, 1888.
- , *of Piston Packing Rings.* By Prof. J. E. Denton, before the Scranton meeting of the American Society of Mechanical Engineers. Gives results of a series of experiments made with a special instrument for measuring the friction of piston packing rings in steam cylinders. *R. R. Gazette*, Oct. 19, 1888; *Amer. Engr.*, Oct. 24, 1888.
- , *of Metal Coils.* By Prof. Hele Shaw and Edward Shaw, before the Bath Meeting of the British Association. *Engineer*, Sept. 28, 1888.
- , *Journal.* See Railroads.
- , *Recent Researches in.* By John Hoodman, before the Students of the Institution of Civil Engineers. Gives a comparison of the results obtained by various authorities and examines the phenomena from a theoretic point of view. *Engr. News*, March 31 *et seq.*, 1888.

- Friction Clutches.** By Geo. Adams. A practical paper on the construction of friction clutches. Illustrated. *Engineer*, Sept. 7, 1888.
- Frictional Gearing on a Dredge.** By J. G. Griffith, before the Institution of Mechanical Engineers. Gives a description of the frictional gearing used on a double steam dredge in the port of Duhlin. Illustrated. *Engineer*, Aug. 24, 1888.
- Frogs and Switches.** Discussion, at the January meeting of the New England Railroad Club, of frogs and safety switches. *R. R. Gazette*, Jan. 20, 1888. *Master Mechanic*, Feb., 1888.
- Foundation, Method Pursued in Replacing a Stone Pier on a Pile.** By J. A. Monroe. Gives description of the method employed to replace on the pile foundation a grillage with two courses of masonry, which had broken loose and settled 14 inches out of place. *Trans. Am. Soc. Civ. Engrs.*, Vol. III., p. 59.
- Foundations for the Brooklyn Anchorage of the East River Bridge.** By T. Collingwood. Gives details of method of construction adopted. *Trans. Am. Soc. C. E.*, Vol. III., pp. 142-146.
- , **Pile.** By Julian Griggs. Describes the common methods of managing pile foundations for bridge masonry and trestles. *Report Ohio Soc. Surv. and Engrs.*, 1888, pp. 209-216.
- , **Replacing, under Elevator at Providence, R. I.** By A. McL. Hawks. Gives details of the method employed to put a new foundation under one side of the Columbia Elevator at Providence, R. I. *Engin. News*, Feb. 25, 1888.
- , **Supporting Power of Soils.** By Randall Hunt. Treats of the supporting power of soils as deduced from personal observation and the recorded examples. *Jour. Assoc. Eng. Soc.*, June, 1888, Vol. VII., pp. 189-196; *Eng. News*, June 16, 1888; *Sci. Am. Supple.*, June 30, 1888; *Engin. and Build. Rec.*, June 23, 1888.
- Foundry Work, Estimating Cost of.** By G. L. Fowler, before the American Society of Mechanical Engineers. Gives outlines of a plan used by the writer to find the cost of castings. *Am. Eng.*, May 9, 1888.
- Fuel, and Combustion.** By R. H. Buel. Gives a general synopsis of the most important principles and data from various sources. *R. R. Gazette*, July 13 *et seq.* 1888.
- , **Liquid.** Details of an interesting series of experiments on liquid fuel made by Mr. B. H. Thwaite. *Engineer*, Dec. 9, 1887.
- , **Liquid.** See Oil Burners.
- , **Petroleum Oil as.** Gives a report of the tests made at the Salem pumping station, to test the value of petroleum as fuel, when converted into and used as gaseous vapor. The oil was found more economical than coal. *Am. Manuf.*, April 6, 1888.
- , **Petroleum Oil vs. Coal.** By C. E. Ashcroft. Considers theoretically and practically the use of petroleum oil as fuel in place of coal. Gives valuable comparisons of test trips on the Russian railroads. *Am. Manuf.*, May 25, 1888.
- Fuel Gas.** By J. M. Cutchlow, before the Ohio Gas Association. *Am. Manufacturer*, March 30, 1888.
- , **and Incandescence Gas Lighting.** By Chas. M. Lungren. Gives comparison of the economy of the different methods of illumination, with figures of cost. *Sci. Am. Supple.*, March 3, 1888.
- , See Gas.
- Furnace, Blast, Charges.** By R. H. Richards and R. W. Lodge. Before the Duluth meeting of the American Institute of Mining Engineers. Gives experiments illustrating the descent of charges in an iron blast furnace. *Engineering*, Jan. 20, 1888.
- Furnaces, Construction of, for Liquid Fuel.** A valuable series of papers by Herr Busley, in *Wochenschrift des Vereines Deutscher*, reviewing the use of liquid fuels. The methods employed are classified and a large number of various appliances of these methods are illustrated and described. Translated in *Engineer*, Feb. 10 *et seq.*, 1888; *Power-Steam*, June *et seq.*, 1888.
- , **Efficiency of Burning Wet Fuel.** By R. H. Thurston. Gives results of experimental investigation made upon two distinct varieties of furnaces burning spent tan-bark wet from the leaches. *Trans. Am. Soc. C. E.*, Vol. III. (1874), pp. 290-318.
- , **Safe Working Pressures for Cylindrical.** By M. Langridge. Discusses the different formulæ relating to the safe working pressure on cylindrical furnaces

- and flues, showing their discrepancies, and proposed a modified form of Fairbairn's formula. *Engineer*, Sept. 21, 1888.
- Gas.** *Loomis Fuel Gas Plant.* Gives brief description of the Loomis fuel gas plant at Tacony, Pa., with account of the Loomis system of production. *Amer. Manuf.*, Oct. 5, 1888.
- , *Natural, Industry at Pittsburgh, Pa.* Gives details of the method of connecting wells to main, regulating pressure, distribution of gas, etc. *Sci. Am. Suppl.*, Jan. 7, 1888.
- , *Substitute for Natural.* Gives details of the Johnson process of manufacturing a fuel gas from crude oil, and the results obtained from burning the gas. *Am. Manuf.*, July 20, 1888.
- , *Water.* An article reprinted from *Industries*, giving analysis of the various forms of water gas. Describes the plant most generally used, chemical reactions, etc. *Am. Manuf.*, Feb. 10, 1888.
- , *Water.* By G. H. Christian, Jr., before the Ohio Gas Light Association. Gives the results of experiments to substitute Lima crude oil for naphtha in the manufacture of water gas. *Am. Manuf.*, April 20, 1888.
- Gas, Water for Metallurgical Purposes.** By A. M. Wilson before the Iron and Steel Institute. Gives analyses of the various forms of water-gas; describes the plant most generally used for its manufacture, chemical reactions, etc. *Sci. Am. Supple.*, July 14, 1888.
- Gaseous Fuel.** By J. E. Dawson before the British Association for the advancement of Sciences. *Am. Manuf.*, Oct. 26, 1888.
- Gas Engines.** See Engines.
- Gas Holders Without Upper Guide Frames.** By T. Newbegg, before the Manchester District Institution of Gas Engineers. Describes a method of constructing gas-boilers with inclined guides at the base, constructed in such a manner as to do away with a large part of the upper frames. *Engineer*, Sept. 14, 1888.
- Gauges, Recording Pressure.** By Chas. A. Hague before the Minneapolis meeting of the American Water-Works Association. Discusses the uses and advantages of recording pressure gauges in water-works. *Proc. Seventh An. Meet. Am. Water-Works Assoc.*, pp. 24-31; *Am. Engr.*, Feb. 8 and 15, 1888.
- Geology.** By Archibald Geikie. A series of articles giving a full treatment of the subject of rock formation. *Sci. Am. Supple.*, Aug. 11 *et seq.*, 1888.
- Garbage, Disposal of.** See Town Refuse.
- Gas. An Oil or Gas Well Rig.** A good description of the ordinary apparatus for drilling for petroleum or natural gas. *Age of Steel*, April 14, 1888.
- , *Compressed Oil Gas and its Applications.* By Arthur Ayres before the Institute of Civil Engineers. Discusses the application of compressed oil gas to light-houses, railroad cars, etc. Describes the Pintsch works at South Foreland. *Proc. Inst. C. E.*, Vol. XCIII., pp. 298-349; *Engineering*, April 13, 1888. Abstracted. *Sci. Am. Supple.*, May 19, 1888.
- , *Fuel.* By Walton Clark before the Western Gas Association. Compares the relative efficiencies of pure fuel gas and a mixture of coal, water and producer gas. *Am. Manuf. and Iron World*, June 22, 1888.
- Girders, Plate, Calculation of.** By A. Münster. Gives results of investigations as to the reliability of formulas in use for calculating [the flange stresses in plate girders. Presents three new formulas. Gives table showing the moments of resistance as compared by different formulas. *Jour. Asso. Engin. Soc.*, February, 1888, pp. 55-58.]
- Governor, Improved Form of Shaft.** By F. H. Ball before the American Society of Mechanical Engineers. *Trans. Am. Soc. Mech. Engrs.*, Vol. IX. (1888), pp. 300-323.
- Gradient, Ruling.** See Railroads.
- Gramophone Etching the Human Voice.** A paper read before the Franklin Institute, May 16, 1888, by Emile Berliner. Sketches the history and present status of the invention. *Jour. Franklin Institute*, June, 1888.
- Guard Rails on Bridges.** See Bridges.
- Gun, Pneumatic.** See Ordnance.
- Hammers, Steam.** By C. Chomienne, Engineer. Translated from the French. The author has had many years experience in the management of extensive iron works. *Railroad and Engineering Journal*, June *et seq.*, 1888.

- Harbor, Antwerp, New Works in.** By M. Strukel. Description, with illustrations, *Zietschr. d. Oester. Ing.-u. Arch. Vereins*, 1833, pp. 151-161.
- , **Karachi, India.** Gives memorandum of works in progress as proposed at an early date for the improvement of the harbor of Karachi, India, with map. *India Engineering*, Feb. 4 *et seq.*, 1888.
- , **New York, Improvement of Water Front.** By J. D. Van Buren, Jr. Gives characteristics of the harbor, physical feature of the island, and the systems adopted for improving the water front, etc. *Trans. Am. Soc. C. E.*, Vol. III., pp. 172-189.
- , **New York, Improvement of.** Gives a brief description of the centrifugal pumps in use on the excavator in New York harbor. *Sci. Am. Sup.*, Aug. 25, 1888.
- Harbors, Physical Phenomena of Entrances to.** An abstract from a lecture by Prof. L. M. Haupt before the American Philosophical Society. *Engr. News*, Feb. 25, 1888.
- Harbor and Waterways, National Bureau of.** Gives text of bill recently introduced into the Senate by Senator Collum, Ill., to establish a National Bureau of Harbor and Waterways. *Engin. and Build. Rec.*, Jan. 28, 1888.
- Heat, Fourier's Law of Diffusion.** By Sir. Wm. Thomson before the Bath meeting of the British Association. Gives five applications of Fourier's law of diffusion, illustrated by a diagram of curves with absolute numerical values. *T. J. and Elec. Review*, Sept. 28, 1888.
- , See Combustion.
- Heat and Power, Prall System of Distribution of.** By E. D. Meier before the Engineers' Club of St. Louis. Gives details of the Prall system of distributing heat and power from a central station as carried out in Boston. *Jour. Assoc. Engin. Soc.*, August, 1888, Vol. VII., pp. 305-313. *Sci. Am. Supple.*, Aug. 25, 1888.
- Heat and Steam, Notes on.** By R. H. Buel. A series of articles for practical men giving a collection of the most prominent data, with tables founded on the same, *Am. Engr.*, May 2 *et seq.*, 1888.
- Heating, Steam.** By Chas. E. Jones. Describes the plant in use at Washington University, and shows the work it is doing, also gives experience with underground pipes and smokeless furnaces. *Jour. Assoc. Engr. Soc.*, January, 1888, pp. 14-22; *Engin. and Build. Rec.*, Feb. 18, 1888. Abstract *Proc. Inst. C. E.*, Vol. XCII., pp. 481-2.
- , **Steam, in Cities.** By Chas. E. Emery. Gives a good exposition of the methods used by the New York Steam Company, with some valuable data. *Jour. Franklin Institute*, March, 1888. *Sci. Am. Supple.*, April 7, 1888.
- , See Car Heating.
- Heating and Ventilating Mass. Institute of Technology.** Gives the results of four years experience with the indirect method of steam heating and ventilating at the Massachusetts Institute of Technology. *Engr. News*, Feb. 25 *et seq.*, 1888.
- , **Warehouse Building.** By Henry J. Snell, before the Philadelphia meeting of the American Society of Mechanical Engineers. Describes a method practiced by the author for heating and ventilating an office and warehouse building in Philadelphia. *Trans. Am. Soc. Mech. Engrs.*, Vol. IX., 1888, pp. 99-107.
- , **Warm Air.** By W. D. Snow. Discusses the uses of a forced current of warm air, and advocates the use of this method, with exhaust steam for shop warming. *Master Mechanic*, May, 1888.
- Heating and Ventilating Workshops.** By John Walker. Gives details of the system of hot air heating applied to some shops in Cleveland. Illustrated. *Jour. Assoc. Eng. Soc.*, Vol. VII., pp. 1-5 (January, 1888).
- Heating Plant, Boston.** Illustrated description of the plant of the Boston Heating Company. *Eng. News*, Nov. 12, 1887.
- , **Boston Heating Co.** By A. P. Abbott, before the Boston Society of Civil Engineers. Gives full description of the plant, the method of construction adopted in the streets and details of fixtures. *Eng. and Build. Rec.*, May 5, *et seq.*
- Heroult Process, Aluminum Alloys by the.** See Aluminum.
- Hydraulic Lift, Bombay Dock.** See Dock.
- Hydraulic Lift, Canal.** A two-page plate showing elevation, cross-section and details, with short description of the La Louvière hydraulic lift on the Canal du Centre, Belgium. Lift, 50.5 ft.; length, 142 ft.; weight, 1,100 tons. *Engineering*, Feb. 24, 1888.

Hydraulic Lift, Car. Brief illustrated description of the hydraulic car lift in the St. Lazare Station in Paris. *Railroad Gazette*, Nov. 18, 1887.

—, *Neuffossé Canal*. Brief description, with sections and elevation of the hydraulic lift at Fontinettes, on the Neuffossé Canal. *Engrs. and Build. Rec.*, June 23, 1888.

Hydraulic Power, Distribution of. By E. B. Ellington, before the Institution of Civil Engineers. Gives details of the distribution of hydraulic power in London. Has 27 miles of mains at a pressure of 700 lbs. per sq. in. *Engineering*, April 27, 1888; *Engineer*, May 11, 1888; *Mech. World*, May 12, 1888; *Amer. Eng.*, June 27, 1888.

Illumination, Economical from Waste Oils. By J. B. Hannay, before the Society of Arts. Describes the lucigen, an apparatus in which compressed air is used with waste oils, and its applications. *Jour. Soc. of Arts*, Dec. 2, 1887; *Sci. Am. Sup.*, Jan. 14, 1888. Abstracted in *Engineering*, Dec. 9, 1887.

Indicator. The Revolving Steam Engine Indicator. An article advocating the use of a steam engine indicator, with a continuously revolving drum, instead of the reciprocating style. *American Machinist*, Dec. 24, 1887.

Indicators. An interesting paper by Chas. E. Emery, before the American Society of Mechanical Engineers, showing the necessity of taking diagrams from the steam-chest at the same time as from the cylinder. Gives actual diagram. *Trans. Am. Soc. Mech. Engrs.*, Vol. IX. (1888), pp. 293-299; *Am. Engr.*, Dec. 7, 1887.

Injector, Mechanics of the. By J. B. Webb, before the Scranton Meeting of the American Society of Mechanical Engineers. *Amer. Engr.*, Oct. 17, 1888.

Injectors and Steam Pumps, Comparative Efficiency of. Finds the relative economy and difference in amount of fuel used with a boiler fed by a pump and by an injector. *Stevens Indicator*, April 20, 1888; *Am. Eng.*, April 18, 1888.

Inland Navigation. Fourteen papers on canals and inland navigation were presented before the recent Canal Conference held under the auspices of the British Society of Arts. They are mostly indexed under canals. See *Jour. Soc. of Arts*, May 25 *et seq.*, 1888.

—, *Proceedings of the 1886 International Convention for Promoting Inland Navigation*, held at Vienna, Austria. *Annales des P. and C.*, June, 1888.

—, *in Germany*. See Railways and Waterways.

—, *in Great Britain*. By E. J. Lloyd before the Society of Arts Canal Conference. Gives history of the development of inland navigation. *Jour. Soc. Arts*, May 25, 1888.

—, *Suggestions for its Improvement*. By M. B. Cotsworth before the Society of Arts Canal Conference. Discusses the present condition of inland navigation in the United Kingdom and gives suggestions for its improvements. *Jour. Soc. Arts*, May 25, 1888.

—, See Canals.

Iron, Influence of Aluminum on. See Aluminum.

—, *Mechanical Properties of Pure, as a standard base*. By President Adamson, before the Iron and Steel Institute. *Amer. Eng.*, July 6, 1888.

—, *Pig*. A lecture before the Franklin Institute, by A. E. Outerbridge, on the production of pig iron, including the relations between its physical properties and chemical constituents. *Sci. Am. Suppl.*, April 14, 1888.

—, *Protection against Corrosion*. By H. Haupt. Describes a new process for protecting iron from corrosion, which treats the heated metal in retorts with steam and hydrocarbon vapor. *Am. Manuf.*, July 6, 1888.

—, *Production of Pig, of a Definite Composition*. By H. Pilkington. Before the South Staffordshire Iron and Steel Institute. *Am. Manuf.*, Jan. 13, 1888.

—, *Relation between Physical Properties and Chemical Constituents of Pig Iron*. Abstract of a lecture before the Franklin Institute, by Alex. E. Outerbridge, Jr. *Journal Franklin Institute*, March, 1888.

—, *Rusting of*. By A. C. Brown, before the Edinburgh meeting of the Iron and Steel Institute. Explains the process involved in the rusting of iron. *Am. Eng.*, Sept. 26, 1888; *Master Mech.*, October, 1888; *Engineer*, Sept. 2, 1888.

—, *Silicon and Sulphur in*. By Thomas Turner before the Iron and Steel Institute. A record of interesting experiments on the effects of an addition of sulphur to cast iron rich in silicon. Concludes that silicon has the power of expelling sulphur from cast iron.

- Iron, Wrought.** Tabulated records in detail of results obtained from over 2,000 test pieces of wrought irons. *Rept. U. S. Board of Testing*, Vol. I., 1881, pp. 46-91.
- , *Wrought, Reolling and Reheating.* Gives the results of experiments on the strength of wrought iron in bars and in chains; effects of different degrees of reduction in rolling, of reheating, reolling and hammering; comparison of chemical causes with physical results, correct form of test pieces, and miscellaneous investigations into the physical properties of rolled wrought iron. *Report of U. S. Board of Testing, etc.*, Vol. 1, 1881, pp. 1-240.
- , *Valuation of Pig.* By A. E. Tucker, before the Society of Chemical Industry. A valuable paper. *Engineering*, July 20, 1888.
- Iron and Steel, Analysis of.** By A. A. Blair. A paper giving the methods used for the analysis of metals for the Board of Testing Iron and Steel, etc. See *Report of Board on Testing, etc.*, 1881, Vol. 1, pp. 248-266.
- , *Internal Stresses in.* By Gen. N. Kalakoutzky. A valuable series of articles giving results of original investigations. Discusses the determination of the influence of internal stresses, method of determining them, reduction, etc. *Engineer*, Dec. 9, 16, 23, 1887; *Sci. Am. Supple.*, Feb. 18, 25, 1888.
- , *Tests of.* Over 700 specimens of iron and steel given in detail. Taken mostly from guns, shot and shell. Watertown Arsenal Report for 1885. Ex. Doc., No. 36, 49th Cong., 1st Session.
- Ironwork Construction in Terry's New Theatre.** By Max Am Ende. Gives description, with drawings of details of the ironwork in Terry's new theatre in London. *Engineer*, Oct. 7, 1887.
- Irrigation.** By M. J. Mack. An interesting description of the Montezuma Valley, Colo., with illustrated details of the irrigation works now being constructed. *Eng. News*, Dec. 31, 1887.
- , *Evils of Canal, in India.* By T. H. Thornton, before the Society of Arts. Discusses the evils arising from canal irrigation in India, viz.: impoverishment of soil, waterlogging and poisoning, and malarial influences, and suggests remedies for them. *Jour. Soc. Arts*, March 23, 1888.
- , *Injurious Effects on Health in India.* By Surg. Gen. H. W. Bellew, before the Society of Arts. Gives results of personal observation of the injurious effects of canal irrigation on the health of the population of the Punjab, and their remedy. *Jour. Soc. Arts*, May 11, 1888.
- , *in India.* See *Agricultural Engineering in India.*
- , *Machinery on the Pacific Coast.* A paper by John Richards, before the Institution of Mechanical Engineers. Describes the methods employed in irrigation and then discusses the different kinds of machinery used. *Engineering*, Nov. 4 et seq.; *Sci. Am. Sup.*, Dec. 17 et seq., 1887.
- Kinometer, Hayne's.** An illustrated description of Hayne's kinometer. It is intended to serve the purpose of a speed indicator, recorder and governor. *Railroad Gazette*, Nov. 18, 1887.
- Lubricants.** By J. E. Denton. A paper before the Nashville meeting of the American Society of Mechanical Engineers, discussing the mechanical significance of the determination of viscosity. *Trans. Am. Soc. Mech. Engr.*, Vol. IX. (1883), pp. 369-376; *R. R. Gazette*, May 11, 1888; *Amer. Engr.*, June 13, 1888.
- , Gives tables showing proportion of various oils commonly used for lubrication. *Engineering*, April 20, 1888.
- , See *Car Axles.*
- Lamps, Maximum Efficiency of Incandescent.** See *Electric Light.*
- Latimer, Charles, Eulogy upon the Life of.** By W. H. Searles, before the Civil Engineers' Club of Cleveland. *Jour. Assoc. Engin. Soc.*, June, 1888, Vol. VII., pp. 201-207.
- Lattice Girders, Stresses in.** See *Bridge.*
- Least Squares.** On some simplifications which may be made in the application of the method of least squares. By Dr. Nell. *Zeitschr. f. Vermessungswesen*, 1887, pp. 454-467.
- Levee, Davis Crevasse.** By S. F. Lewis, before the American Society of Civil Engineers. Gives details of the break in Davis levee, near New Orleans, and the method adopted in its repair. *Trans. Am. Soc. C. E.*, Oct., 1888, pp. 199-204.
- Levees of the Mississippi River.** By Caleb G. Forshay. Gives outlines of history

- of levees on the Mississippi; discusses the forms and dimensions and what is required of a levee. A valuable paper. *Trans. Am. Soc. C. E.*, Vol. III. (1874), pp. 267-284.
- Light-House, Rothersand.** By O. Offergeld, before the Association of Architects and Engineers, at Hamburg. Gives details of the construction of the Rothersand light-house in the North Sea, with two-page plate showing plans and sections of the pneumatic caisson. Valuable. *Engineering*, Dec. 2 and 16, 1887.
- Lighting Railroad Trains.** Abstract of the report on car lighting presented at the International Railroad Congress held at Milan, in September. *Railroad Gazette*, Nov. 18, 1887.
- Lightning, Protection of Buildings from.** A lecture by Prof. Oliver J. Lodge before the Society of Arts. *Jour. Soc. Arts*, June 15, 1888.
- Liquid Fuel for Gas Retorts.** Gives details of experiments made on burning coal tar under gas retorts with the Drury spray nozzles. Illustrated. *Engineer*, Sept. 7, 1888.
- Locomotive. Circulation in Boilers.** By John Hickey, before the Western Railway Club. Discusses the proper construction of locomotive boilers and fire-boxes to obtain the most economic results. *Master Mechanic*, October, 1888. Discussion on this paper in *Master Mechanic* for November.
- , **Compound.** Gives plan, elevation and cross-section of a compound locomotive, Warsdell and Von Borries system, of the Bengal & Nagpor Railroad. *Engineer*, July 20, 1888.
- , **Compound Express.** Gives a two-page plate showing sectional elevation and plan of a compound express locomotive built for the Northeastern Railway, Eng. *Engineering*, March 30, 1888. Details of tests of these engines in *Engineering*, April 13, 1888.
- , **Compound Tank.** Gives two-page plate of elevation and plan, with dimensions, and brief description of a freight locomotive, Webb's system and Joy's valve motion, for the London & Northwestern Railway. *Engineering*, Dec. 23, 1887.
- , **Distribution of Steam in the Strong.** By F. W. Dean, before the American Society of Mechanical Engineers. Abstracted, *R. R. Gazette*, May 25, 1888.
- Locomotives, Draft Appliances in.** A paper by F. C. Smith before the April meeting of the Western Railroad Club. Gives results of experiments made on a number of engines to see what could be done to obtain a better efficiency. Discussion. *R. R. Gazette*, April 20, 1888; *Master Mechanic*, May, 1888; *Nat. Car and Loco. Builder*, May, 1888.
- , **Estrade's High-speed.** An illustrated description and criticism of Estrade's high-speed locomotive. It has six driving wheels 6' 3" in diameter, cylinders $18\frac{1}{2} \times 27\frac{1}{2}$, with a weight of 42 tons. *Engineer*, March 9, 1888; *Sci. Am. Supple.*, April 28, 1888.
- , **Express, Baltimore & Ohio.** Gives a brief description, with two-page plate, and extracts from the specifications of a new eight-wheel locomotive built for the Baltimore & Ohio Railroad. Its dimensions are: Cylinders, 19 by 20 in.; drivers, 66 in.; boiler, 53 in.; tubes, 174; weight on drivers, 70,000 lbs.; total weight, 102,000 lbs.; *Master Mechanic*, May, 1888.
- , **Express, Caledonian Railway.** Gives brief description of an express engine that made 101 miles in 104 minutes. Cylinders, 18×26 in.; driving-wheels, 84 in.; weight, 94,000. *R. R. Gazette*, Aug. 24, 1888.
- , **Express, C. & N. R. R.** Gives brief description, with two-page plate, giving sectional elevation, half plan and cross-section of a passenger locomotive for the Chicago & Northwestern Railroad. *R. R. Gazette*, Dec. 23, 1887.
- , **Express, Mich. Cent. R. R.** Brief description, with drawings, showing sectional elevation, half-plan and cross-section of a standard eight-wheeled passenger engine for the Michigan Central Railroad. *Mast. Mech.*, August, 1887.
- , **Express, Midland R. R.** Two-page plate giving sectional plan and elevation, with dimensions of an inside cylinder, four-coupled type of express engine for the Midland R. R. Co. *Engineering*, Dec. 9, 1887.
- , **Express, N. Y. L. E. & W.** Gives double-page plate showing elevation and half-plan, also smaller drawing showing sections and details with dimensions. *R. R. Gazette*, Jan. 6, 1888.
- , **Express, Ten-wheel, M. C. R. R.** Gives elevation of a ten-wheel locomotive

- huilt for the Michigan Central Railroad, with specifications giving the leading dimensions. *R. R. Gazette*, Feb. 24, 1888.
- Locomotive, Express, Wootten, U. P. R. R.** Brief description, with detailed drawings of passenger engines with the Wootten fire-box built for the Union Pacific Railroad. Cylinders, 18 by 26 inches; drivers, 63 inches; weight on drivers, 76,500 pounds; total weight, 118,500 pounds. *R. R. Gazette* June, 15, July 6, Aug. 11, Sept. 7 and Oct. 5, 1888.
- , *Freight, C., B. & N. R. R.* Gives a two-page plate showing sectional elevation and half plan, other cuts showing cross sections of a ten-wheel locomotive of the Chicago, Burlington & Northern Railroad. *Master Mechanic*, December, 1887.
- , *Freight, N. N. & M. V. R. R.* Give specifications for a ten-wheeled freight engine for the Newport News & Mississippi Valley Company. Drawings with dimensions showing elevation of engine, also details of coupling, connection and eccentric rods, rocker box, crank pins, links, etc. *Railroad Gazette*, March 16, 1888.
- , *Freight Mogul, D., L. & W. R. R.* Gives short description, with elevations and cross-sections, and dimensions of a freight engine, of the Mogul type, for the Delaware, Lackawanna & Western Railroad. *R. R. Gazette*, Feb. 3, 1888.
- , *Hungarian State Railroads.* Gives a two-paged plate, showing sectional elevation and plans of a tank locomotive, of which 60 are in use on the Hungarian state railroads. They evaporate $4\frac{1}{2}$ lbs. of water per pound, and haul 280 tons up incline 1 in 150, at a speed of 13 miles per hour. *Engineer*, Feb. 3, 1888.
- , *Imperial Railroads, Japan.* A two-paged plate showing sectional elevation and plan of a tank locomotive for the imperial railroads of Japan. They are 3 feet 6 inches gauge, two pairs drivers 4 feet 4 inches in diameter, 14×20 inch cylinder; weigh $32\frac{1}{2}$ tons, with 20 tons coupled to wheels. *Engineering*, Feb. 10, 1888.
- , *Indian State Railroad.* Gives brief description, with plan and elevation, of a six-coupled metre gauge locomotive for the Indian State Railroad. *Engineer*, March 27, 1888.
- , *Light Tramway.* Gives brief illustrated description of the locomotives used on the Cavan, Leitrim and Roscommon tramway, Ireland. *Engineer*, April 20, 1888.
- , *Lancashire and Yorkshire.* Gives longitudinal section and description, with dimensions of engine and tender, of a passenger engine for the Lancashire and Yorkshire Railway Co. *Engineer*, Aug. 26, 1887.
- , *London and Southwestern.* Gives description and specifications, with a two-page plate of detailed drawings of a four-coupled, outside cylinder locomotive, *Engineer*, Nov. 4 and 11, 1887.
- , *Passenger, C., B. & Q.* Gives a description, with drawings, showing sectional elevation, half-plan and eight half-section of a heavy passenger engine, Mogul type, weighing 110,000 lbs., for the C., B. & Q. Railroad. *Master Mechanic*, February, 1888.
- , *Passenger, N. Y., L. E. & W. R. R.* Gives elevation, half-plan and three cross sections, with brief description, of a high-speed passenger engine for the New York, Lake Erie & Western Railroad. It has two pairs of 68-inch drivers, cylinder 19×24 , and weighs 115,000 lbs., with 78,000 on the drivers. *Nat. Car and Loco. Builder*, April, 1888.
- , *Passenger, Caledonian Railroad.* Gives half plan, elevation and cross-section of a passenger locomotive for the Caledonian Railroad. It has two pairs 5 ft. 9 in. drivers, cylinders 18×26 in., and weighs 83,000 lbs. *Engineer*, April 13, 1888.
- , *Passenger Ten-wheel.* Gives drawing and description, with specification of ten-wheel locomotive built by the Schenectady Locomotive Works for the Colorado Midland Railroad. *Railroad Gazette*, Nov. 25, 1887.
- , *Philadelphia & Reading R. R.* Gives outlines engraving of the four classes of new locomotives to take the place of the Wootten locomotives on the Philadelphia & Reading Railroad. *Nat. Car and Loco. Builder*, April, 1888.
- , *Road, McLaren's High-Speed.* Describes a compound 12 horse-power road engine working with a pressure of 175 lbs. *Engineer*, Dec. 16, 1887.
- , *Strong.* A brief description of the Strong locomotive. Illustrated, with reasons for the peculiar features in its design. By George S. Strong. Also a summary of the results of trials of the engine on the Lehigh Valley Railroad, made by E. D. Leavitt. *The Journal of the Franklin Institute*, February, 1888.

- Locomotive, Tramway.** Describes a small, powerful condensing engine for street work. Illustrated. *Engineer*, Oct. 21, 1887.
- , *Tramway.* Brief illustrated description of Burrell's tramway locomotive, that gave very good results in Birmingham. *Engineer*, Oct. 28, 1887.
- , *Test of.* Gives details of a test made of a locomotive on the New Jersey Central Railroad, by Messrs. H. S. Wynkoop and John Wolff, with tables and indicator diagrams. *R. R. Gazette*, Aug. 17, 1888.
- , *Tests Comparing Radial Motion and Link Motion.* By Angus Sinclair. Gives details of test trips made on the Burlington, Cedar Rapids & Northern Railroad, with engines of similar dimensions but equipped with different valve-gear. Gives 38 indicator diagrams. *Nat. Car & Loco. Builder*, April, 1888.
- , *Compound.* Gives a method of computing the mean pressures. *Mech. World*, March 10, 1888.
- , *Coupling and Connecting Rods.* A series of papers on the proper design of coupling and connecting rods for locomotives. *Engineer*, May 25 *et seq.*, 1888.
- , *Cost of Rebuilding.* Gives details of the cost of rebuilding a locomotive at the Ohio & Mississippi railroad shops at Vincennes, Ind. Also an editorial on the subject. *R. R. Gazette*, Oct. 19, 1888.
- , *Counterbalancing of.* By Prof. Lanza, before the Scranton meeting of the American Society of Mechanical Engineers. Gives results of experiments on the effects of different methods for counterbalancing the reciprocating parts of a locomotive. *Master Mechanic*, November, 1888; *R. R. Gazette*, Oct. 19, 1888.
- , *Extension Fronts and Fire-Box Arches.* Gives the report of the committee of the Master Car-Builders' Association on extension fronts and fire-box arches. *R. R. Gazette*, June 22, 1888; *Nat. Car and Locomotive Builder*, July, 1888; *Master Mechanic*, July, 1888.
- , *Extension Front of.* Gives sectional drawings with dimensions of the extended front on the Fremont, Elkhorn & Missouri Valley Railroad. Also, discussion of the different forms of smoke-boxes by the Western Railroad Club. *Nat. Car and Loco. Builder*, December, 1887.
- , *High and Low.* By Prof. A. G. Greenhill. A mathematical treatment of why a high locomotive will run with greater safety and steadiness than a low one. *Engineer*, Dec. 2, 1887.
- , *Specifications for.* Gives drawing-room specifications for express locomotives built at the Baldwin works, for the New York, New Haven & Hartford Railroad. *Master Mechanic*, September, 1888.
- , *Water for, and Practice in Washing out Boilers.* By G. A. Gibbs, at January meeting of Western Railway Club. Treats the subject from a practical point of view. Gives some experience gained by the Chicago, Milwaukee & St. Paul Railroad. *R. R. Gazette*, Jan. 20, 1888.
- Machine Construction, Milling Machine as a Substitute for the Planer in.** By J. J. Grant before the American Society of Mechanical Engineers. Gives data relating to the cost of work on the two machines. Shows the milling machine to be the cheaper. *Trans. Am. Soc. Mech. Engrs.*, Vol. IX. (1888), pp. 259-269; abstracted in *R. R. Gaz.*, Jan. 6, 1888; *Mech. World*, Dec. 17, 1887.
- Machine Designing.** By John E. Sweet. A lecture delivered before the Franklin Institute. Illustrated. *Sci. Am. Supple.*, April 28, 1888; [abstracted *R. R. Gaz.*, June 15, 1888.
- Magnetism** See Watches, Protection of; also Paillard's Non-Magnetic Balances and Hair Springs for.
- Manganese Steel.** See Steel.
- Measures, Standard.** By E. A. Gieseler. Gives brief history of the development of standards of length, describes the present standards of the United States and the methods adapted to compare them with other standards, etc. *Jour. Franklin Institute*, August, 1888; *Engr. News*, Sept. 8, 1888.
- Mechanical Engineering, Chalk Age of.** By J. T. Halloway. Fifth lecture before the students at Cornell University. Gives picture of engineering practices of days gone by and the contrast between the former and modern practice. *Sci. Am. Supple.*, June 16, 1888.
- Mechanical Engineers, Advice to Young.** By Prof. Perry to the students at Finsbury Technical College. A valuable paper for working engineers, *Sci. Am. Supple.*, Sept. 1, 1888.

- Metallic Compounds.** A long list of authorities on metallic compounds may be found in the *Report of U. S. Board of Testing Iron, etc.*, Vol. I., 1881, pp. 149-210.
- Meter, Forbes'.** Description of various forms and analysis of patent claims. By Prof. Edwin J. Houston. Also paper by Prof. George Forbes, describing his electrical current meter, read before the Franklin Institute, Oct. 19, 1887. *Journal of the Franklin Institute*, Dec., 1887, Vol. CXXIV., No. 744.
- See Water Meters.
- Milling, Modern.** By Gilbert Little. An illustrated series of articles dealing with the birth and development of the Hungarian or Semolina system. *Engineer*, July 15, etc., 1887.
- Mineral Production for 1887, Statistics of.** Good summaries of the production and prices of zinc, copper, coal, coke and pig-iron for the past year will be found in *Eng. and Min. Jour.*, Jan. 7, 1888.
- Mining Appliances in Westphalia.** By Messrs. Malkel, De Gournay and Suisse. Gives notes on the machinery, appliances, mode of working, etc., of the collieries of Westphalia. *Proc. Inst. C. E.*, Vol. XCII., pp. 367-376.
- *Mica in North Carolina.* By Wm. B. Phillips. "A series of papers describing the geology of the mining districts, formation of the veins, dressing the mica, etc. *Engin. and Min. Jour.*, April 21 et seq., 1888; *Sci. Am. Supple.*, July 21 et seq., 1888.
- *Ores and their Mode of Occurrence at Aspen Mountain, Colo.* By D. W. Bounton. A series of illustrated articles describing the ore deposits and the faulting of the Aspen district, Colorado. *Engin. and Min. Jour.*, July 14 et seq., 1888.
- *Ore Deposits of Red Mountain, Colo.* By G. E. Kedzie before the American Institute of Mining Engineers. Gives a description of the bedded ore deposits of Red Mountain mining district, Colo. *Engin. and Min. Jour.*, Aug. 11, 1888.
- *Systems of, in Large Bodies of Soft Ore.* By R. P. Rothwell, before the Boston meeting of the American Institute of Mining Engineers. Describes the system employed at the Dean River mine and proposes working the vein out from the top down instead of from the bottom up. *Engin. and Mining Jour.*, March 10, 1888.
- *Theory of Shot-Firing in.* By M. P. F. Chalon. Gives a general theory of shot-firing with common powder or high explosives. *Eng. News*, Jan. 14, 1887.
- Mining Engineering.** By J. L. Culley. A paper involving the general principles of mining engineering, relating particularly to coal bank work as pursued in Ohio. *Engin. News*, March 10, 1888.
- Mortar. Efflorescence and Impervious.** By Ira O. Baker. Gives reason of efflorescence and discusses its remedy. Also discusses the use of soap and alum to render brick and mortar impervious. *Engin. News*, April 7, 1888.
- *Making and Using.* By B. F. Bowen. Contains much useful information relative to lime mortar. *Rpt. Ohio Soc. Surv. and Engrs.*, 1888, pp. 223-31.
- Moment Diagram for Bridge Strains.** See Bridge Strains.
- Motor, Mekarski's Compressed Air.** Gives an illustrated description of the Mekarski compressed air motor for street railroads, several of which are now working on a London road. *Engineering*, March 23, 1888.
- *Thermo.* See Engine.
- *Parson's Steam Turbine.* Gives description with results of the practical working of Parson's steam turbine. The best results so far attained are a consumption of 52 pounds of steam an hour for each electric horse-power with steam at 90 pounds pressure above the atmosphere. *Engineering*, Jan. 13, 1888; *Sci. Am. Sup.*, Feb. 11, 1887.
- *Triple Thermic.* By Chas. H. Haswell before the American Society of Civil Engineers. Gives description, operation and results of a single expansion, non-condensing steam engine, supplemented by the evaporation of bisulphide of carbon and expansion of its vapor. *Trans. Am. Soc. C. E.*, Vol. XVII., pp. 193-199, October, 1888; *Sci. Am. Supple.*, April 14, 1888; *Engineer*, June 1, 1888.
- *for Alternating Currents.* See Electric Motors.
- See Dynamo.
- Masonry, Proper Construction and Cost of.** By T. H. McKenzie, before the Connecticut Association of Civil Engineers and Surveyors. Gives specifications, with comments, for first-class masonry. *Proc. Conn. Assoc. C. E. & Surv.*, 1888, pp. 45-54.

- Masonry and Stone Cutting.** By Law. Harvey. A series of articles giving instruction in the draughting of details of masonry. *Build. News*, Dec. 11 *et seq.*, 1887.
- Municipal Engineer and the Management of his Office.** By B. Schreiner. Gives good hints relative to the management of the offices of city engineers. *Jour. Assoc. Engr. Assoc.*, January, 1888, pp. 9-12. *Engin. and Build. Rec.*, May 12, 1888.
- Masonry, Government Specifications for.** Gives the regular specifications for stone work in use in the Government architect's office. *Eng. News*, June 2, 1888.
- Oil Burners for Steam Boilers.** Abstract of a series of papers by Herr Busley, of Kiel, a marine engineer, describing the leading or typical devices which have been and are used for burning liquid fuel, under the following classification: 1. Hearth fires. 2. Gas fires. 3. Spray fires. *Railroad and Engineering Journal*, April, May, June 1888.
- Oil Wells.** See Gas.
- Ordnance.** *The Zalinski Pneumatic Torpedo Gun.* Extracts from a paper by Capt. E. L. Zalinski, U. S. A., read before the U. S. Naval Institute, December, 1887, on the Naval Uses of the Pneumatic Torpedo Gun. *Railroad and Engineering Journal*, May, 1888.
- Ore Sorting.** By T. L. Bartlett. Gives a description of the method of ore sorting employed at Milan mine. *Eng. & Min. Jour.*, April 14, 1888.
- Ore-Deposits, Forms of, in Limestone.** By Carl Henrich. Describes the peculiar form of galena deposits in Missouri. *Eng. and Min. Jour.*, Nov. 3, 1888.
- Ore-Deposits, Geology of the Aspen, Col.** By L. D. Siver. *Engin. and Mining Jour.*, March 17 *et seq.*, 1888.
- Ore, Dressing of Non-Bessemer.** By G. W. Maynard and W. B. Kunhardt. *Engin. and Mining Jour.*, March 31 *et seq.*, 1887.
- . See Mining.
- Pantograph; Its Theory and its Use.** By E. A. Gieseler. *Eng. News*, Nov. 26, 1887.
- Passenger Car Truck.** Gives detailed drawings with dimensions of a passenger truck with eight brake shoes. *R. R. Gaz.*, Dec. 9, 1887.
- Patents, Reforms needed in the U. S. Patent Office.** Report of the Legal Committee of the National Electric Light Association on the above subject at the Pittsburgh meeting. *Electrical Engineer*, March, 1888; *Electrical World*, March 3, 1888.
- Pavements, Asphalt.** A report by W. P. Rice to the Board of Improvement of Cleveland on the use of Asphalt Pavements. *Engin. and Build. Rec.*, May 26, 1888.
- , *Asphalt and Concrete Foot.* By G. R. Straehan, before the Association of Municipal and Sanitary Engineers and Surveyors, at Leicester. Gives details of experiments with asphalt walks in England, with data of durability, cost, etc. *Sci. Am. Sup.*, Dec. 31, 1887.
- , *Cleveland, O.* By M. E. Rawson. Describes the methods of construction, specifications and durability of the Cleveland pavements. *Rpt. Ohio Soc. Surv. and Engs.*, 1888, pp. 70-95.
- , *Sydney, N. S. W.* By A. C. Mountain. Before the Institution of Civil Engineers. Gives details of the pavements, principally wooden, of the city of Sydney, New South Wales; also description of and results of tests on Australian timber. *Proc. Inst. C. E.*, Vol. XCIII., pp. 364-382.
- Paving, Valuation of Road Metal and Setts for.** By W. F. Stock. Discusses the salient features to be looked at in selecting road material, and gives results of examinations made with a machine for testing the abrasion resistance of road metal. *Eng. News*, Sept. 22, 1888.
- , *Notes on.* By T. R. Wickenden. Object of paper is to call attention to desirable as well as objectionable qualities of various pavements in general use. *Rpt. Ohio Soc. Surv. and Engs.*, 1888, pp. 69-75.
- Pavements, Repairing, Cleansing and Watering.** Extracts from a report of George Livingston, Surveyor, of St. George, London. Gives details of the methods employed in repairing, cleansing and watering 40 miles of macadamized streets. *Eng. and Build. Rec.*, Jan. 7, 1888.
- , *Specification for Material.* Gives specifications for the supply and delivery of wood blocks for paving portions of the street known as King's road and Pont street, in Parish of Chelsea. *San. Engr.*, Dec. 31, 1887.

- Pavements, Specification for Wood.** Gives specifications for wood pavement in Parish of St. George, London. Said to be one of the best recently written. *San. Engr.*, Dec. 24, 1887.
- , *Wood in Paris.* Gives a translation of the specifications and principal instructions issued in 1886. *Eng. and Build. Rec.*, June 9, 1888.
- , *Wood in Paris.* An abstract from a paper by M. A. Laurent in *Genie Civil* gives details of the present practice of paving with wood in Paris. *Eng. & Build. Rec.*, April 7, 1888.
- Permanent Way.** See Railroads.
- Petroleum, Transportation of, in Russia.** Gives a detailed account of the proposed 8-in. pipe line from Baku to Port of Batam. Length of line 497 miles, with 24 stations, each of which contain four 150 horse-power engines. Delivery estimated at 110 cuh. ft. per minute. *Engineering*, Feb. 3, 1888.
- Pier, Marine Park, Boston.** Short description, with full detail drawings, of the iron pier at Marine Park, Boston. It has twelve spans, 60 feet each, resting on cast-iron pins filled with concrete. *Engin. and Build. Rec.*, Jan. 28, 1888.
- , *St. Leonards-on-Sea.* Gives brief description, with drawing of details of a screw pile promenade pier 900 ft. long and 25 ft. wide, being built at St. Leonards-on-Sea, England. *Engineer*, May 11, 1888; *Sci. Am. Supple.*, June 23, 1888.
- Pig Iron.** See Iron.
- Pile Trestles.** Gives detailed drawings of the standard trestle of the Chicago, Burlington & Northern Railroad. *Engin. News*, May 5, 1888.
- Piles, Supporting Power of.** By Prof. J. O. Baker. Discusses the formula of Mr. Trautwine, and shows its defects. Gives an empirical formula derived by Mr. Hertz from driving of over 400 piles. *R. R. Gazette*, April 6, 1888.
- , *Protection of, from Limnoria and Teredo.* By M. Manson, before the American Society of Civil Engineers. Gives details of the treatment of piles for the Mission street pier, San Francisco, by various methods, and the condition of piles after five year's service. An abstract in *San. Engr.*, Dec. 31, 1887; *Engineer*, Jan. 6, 1888.
- Pipe. Standard Pipe and Pipe Threads.** Report of a committee of the American Society of Mechanical Engineers, read at their New York meeting, November, 1876. Recommends the adoption of the Briggs standard, already in quite general use. *Transactions of the American Soc. of Mechanical Engineers*, Vol. VIII., 1887.
- , *Strength of a Copper Steam.* Gives an abstract from a report for the Board of Trade Surveyors on the testing of a copper steam pipe taken from a steamship. *Engineering*, Sept. 14, 1888.
- , *Copper, Strength of.* Gives table of results of a large number of tests made at the Lancefield Engine Works to ascertain some of the mechanical properties of the copper and brazing found in ordinary high-pressure steam pipes of large size. *Engineering*, Dec. 31, 1887.
- Piping.** See Water-Works.
- Planimeter, Corade's Rolling.** By Prof. F. Locher. A description and theoretical study of Corade's rolling planimeter. *Zeitschr. f. Vermessungswesen*, 1887, pp. 377-383; 421-437.
- , *New Spherical.* By Prof. Hele Shaw. Gives an illustrated description, with theory of action, of a new spherical planimeter. *Engineering News*, Oct. 13, 1888.
- , *Polar.* E. A. Gieseler. Gives a mathematical discussion of the theory and use of the polar planimeter. *Sci. Am. Supple.*, March 17, 1888.
- Plumbing, Specifications for.** Gives specifications of the Board of Health for plumbing in New York City. *Engin. & Building Rec.*, July 21, 1888.
- Pneumatic Foundation of a Tidal Basin Entrance Lock at Dieppe, France.** Under over 55 feet head of water; area of caisson, about 120 feet by 115 feet. *Annales des P. and C.*, November, 1887.
- Pontoons.** See Docks.
- Power, Hydraulic in London.** By Baggand Ellington, before the Institution of Civil Engineers. Gives a description of plant of Hydraulic Power Company of London. *Engineer*, May 11, 1888; *Engineering*, April 27, 1888; *Am. Engr.*, June 27, 1888; *Mech. World*, May 12, 1888; *Engin. and Min. Jour.*, Nov. 3, 1888.

- Power, Press Problems.** By Oberlin Smith, before the Philadelphia meeting of the American Society of Mechanical Engineers. *Trans. Am. Soc. Mech. Engrs.*, Vol. IX. (1888), pp. 161-171.
- Propulsion of Ships by Air Propellers.** By H. Vogt before the Bath Meeting of the British Association. Gives details of experiments made with propellers working in the air instead of the water. *Engineer*, Sept. 23, 1888.
- , *On the Laws of Steamships.* *Engineer*, July 27, 1888.
- Propellers.** A paper by C. Trathen on the practical geometry of the screw propeller. *Mechanical World*, Feb. 4, 1888.
- Public Works, Cullom-Breckenridge Bill.** Arguments on the Cullom-Breckenridge Bill by a Committee of the St. Louis Engineers' Club. A pamphlet of 19 pages. Copies may be had by addressing Prof. J. B. Johnson, St. Louis, Mo.
- Pumps, Centrifugal, their efficiencies.** By Wm. O. Webber before the American Society of Mechanical Engineers. Gives details of experiments made upon centrifugal pumps. *Trans. Am. Soc. Mech. Engrs.*, Vol. IX., pp. 223-246.
- , See Water-Works.
- , *Mercurial Air.* By Prof. S. P. Thompson, before the Society of Arts. A very complete paper, tracing the development of the mercurial air pump. Gives cuts of the various machines and the results attained with some of them. *Jour. Soc. of Arts*, Nov. 25, 1887; *Sci. Am. Sup.*, Jan. 21 et seq., 1888. Abstracted *Engineering*, Nov. 25, 1887.
- Pumping, Electric.** Brief description of an electrical pumping plant at St. John Colliery, Normanton, Eng. Efficiency, 41.4 per cent. *Engineer*, Dec. 2, 1887.
- , *Electric, in Collieries.* By Frank Brain, before South Wales Institute of Engineers. Gives details of the pumping plant at the Trafalgar collieries. Gives an analysis of the work done, showing the per cent. lost in different parts of plant; also gives comparison of cost of underground haulage by electricity, cables, compressed air and hydraulics. *Mech. World*, Dec. 24, 1887; *Am. Engineer*, Jan. 11 and 18, 1888.
- Pumping Engine, Chicago.** The report of Mr. F. W. Gerecke to the Commissioner of Public Works on the condition and capacity of the pumping engines of the water-works. *Am. Engr.*, March 14 et seq., 1888.
- Pumping Engines, Whampoa Docks.** Brief illustrated description of the large centrifugal pumping engines in use at Whampoa Docks, Hong Kong. *Engineer*, Nov. 18, 1887.
- , *Leicester.* Specifications for the erection of pumping engines, etc., for the Beaumont Lego pumping station, Leicester. *Engineer*, Aug. 12, 1887.
- Pumping Machinery. Types of Hydraulic Pumping Machinery.** By J. T. Fanning. A short historical and descriptive paper, with cut showing an improved form of turbine pumping machinery. *Jour. New Eng. W. Works Assoc.*, Sept., 1886.
- Propellers, Experiments with Screw.** By J. B. Andreae, before the Institute of Naval Architects. Gives details of experiments with four and two-bladed propellers. *Engineering*, April 13, 1888; *Sci. Am. Sup.*, May 19, 1888.
- Railroad, Abt System, Indian Experiments.** Gives details of experiments made on a section railroad built on the Abt system over the Bolan Pass. *Engineer*, July 13, 1888.
- , *Canadian Pacific.* The annual address of the President of the American Society of Civil Engineers, Mr. T. C. Keefer, read at the annual convention of 1888. Gives details of construction of the Canadian Pacific Railroad. Abstracted in *R. R. Gazette*, July 6, 1888. Also *Sci. Am. Supple.*, Aug. 4, 1888.
- , *European, as they Appear to an American Engineer.* W. H. White. Gives brief description of some of the most prominent features in the construction and workings of the European railroads. *Trans. Am. Soc. Civ. Engrs.*, Vol. III., p. 61.
- , *Inclined, Lookout Mountain.* By W. H. Adams, before the American Society of Mechanical Engineers. Gives full description of the inclined railroad up Lookout Mountain, Tenn., with profile and plan of road, engine plant and details of cars, etc. *Eng. News*, Jan. 7, 1888; *Sci. Am. Supple.*, May 12, 1888; *Engineering*, March 30, 1888. Abstracted *Proc. Inst. C. E.*, Vol. XCII., pp. 463-4.
- , *Lartigue System.* Gives brief description of Listowel & Ballybunion Railroad, Ireland. It is 10 miles long and built on the Lartigue single rail system.

- Gives cuts of rolling stock and details of roadbed. *Engineer*, March 2 and 9, 1888. *Sci. Am. Supple.*, April 7, 1888.
- Railroad, Gauges of the World.** An abstract from an article by Herr Claus in *Glaser's Annalen*, showing the history and development of the railroad gauges of the world. *R. R. Gazette*, Sept. 14, 1888.
- , *Pacific, and the Government.* Editorials showing how the present difficulties have arisen, and examines the plans proposed for their salvation. *R. R. Gazette*, Jan. 27 *et seq.*, 1887.
- , *Signals, Automatic.* Gives a description of the automatic signals in use on the Fitchburg Railroad, Mass. *R. R. Gazette*, June 15, 1888.
- , *Switch, Standard Point.* Gives full detailed drawings of the standard point switch of the Boston & Albany Railroad. *R. R. Gazette*, March 2, 1888; *Engin. News*, March 31, 1888.
- , *Building a Second Track.* By H. C. Thompson, before the Civil Engineers' Club of Cleveland. Discusses the question of building an additional track to a single track railroad already in operation. *Jour. Assoc. Engin. Soc.*, April, 1888.
- , *Classification of Accounts, etc.* By G. Mordecai, before the American Society of Civil Engineers. Gives notes on the classification of railroad accounts and the analysis of railroad rates. *Trans. Am. Soc. C. E.*, Vol. XVIII., February, 1888, pp. 62-68.
- , *Cause of Shock.* By H. Hollerith. Discusses the shock produced in stopping trains in the light of the theory of impact. *R. R. Gazette*, April 27, 1888.
- , *Depreciation of Freight Cars.* Gives a table showing the value of a freight car at any age, estimated at 6 per cent. per annum as per Master Car-Builders' rules. *R. R. Gazette*, April 27, 1888.
- , *Effect of rail upon wheel, and of wheel upon rail.* Review of book by Boedeker, Hanover, 1887. Hahn, publisher.
- , *Freight-car Couplers.* Gives text of the progress report of the Shinn Committee on Uniform Couplers. *R. R. Gaz.*, Dec. 9, 1887.
- , *Frogs and Switches.* By W. F. Ellis, before the January meeting New England Railroad Club. Discusses and advocates the use of spring-rail frogs. Discusses safety switches and advocates the split or point switch. *Master Mechanic*, Feb., 1888.
- , *Frogs and Safety Switches.* By Geo. Richards, before the New England Railroad Club. Discusses the development of switches and frogs, and gives the qualities of a good safety switch. *Master Mechanic*, February, 1888.
- , *German Switch Movement.* Gives a translation of a lecture before the Berlin Railroad Club discussing the arrangements by which a close contact in split switch worked from a distance is obtained. *R. R. Gazette*, Aug. 10, 1888.
- , *Interlocking Apparatus, L. I. R. R.* Gives a brief description with illustrated details of the interlocking apparatus on the Long Island Railroad. *R. R. Gazette*, Feb. 10, 1888.
- , *Interlocking Switches and Signals.* By Charles R. Johnson. A series of papers showing the progress made in the use of interlocking switches and signals, and the modifications in practice. *R. R. Gazette*, May 4 *et seq.*, 1888.
- , *Journal Friction and Train Resistance on.* An address before the March meeting of the Western Railroad Club by G. W. Rhodes. *Master Mechanic*, April, 1888.
- , *Maintenance of Track.* By John M. Goodwin. An attempt to show the relation existing between the cost of track maintenance and the use of steel rails. *R. R. Gazette*, May 4, 1884.
- , *Ruling Gradient.* By E. Holbrook. Discusses how to determine the best gradient for a railroad. *Sci. Am. Supple.*, July 21, 1888; *R. R. Gazette*, July 27, 1888.
- , *Steel Ties.* By J. W. Post. Before the annual convention of the American Society of Civil Engineers. Gives cost of maintaining track on steel ties on the Netherland State railroads. *Engin. News*, June 30, 1888.
- , *Permanent Way.* Gives a summary of returns received in reply to circular issued under a resolution pertaining to roadway adopted at a meeting of the Association of North American Railroad Superintendents, Oct. 11, 1887. *R. R. Gazette*, April 13, 1888.
- , *South African.* Gives map showing their location and data of population, trade, etc. *R. R. Gaz.*, Nov. 25, 1887.

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- , *Lighting and Ventilation.* Discussion of the above subjects by the New York Railroad Club. *R. R. Gazette*, Nov. 25, 1887.
- , *Locomotive and Car Shops, C., St. P. & K. C. R. R.* Gives general and detailed plans of the locomotive and car shops of the Chicago, St. Paul & Kansas City Railroad at St. Paul. *R. R. Gazette*, Feb. 10, 1888.
- , *Ratio of Population* to Mileage.* By W. H. White. Gives diagram showing the ratio of population to railroad mileage, and the probable increase of mileage demanded. *R. R. Gazette*, Oct. 5, 1888.
- , *Relative Cost of Transporting Car-loads and Less than Car-load Lots.* Gives the testimony of Mr. Fink before Inter-State Commerce Commission. Submitted a statement based upon statistics. A valuable paper. *R. R. Gazette*, Feb. 3, 1888.
- , *Rolling Stock and Tramways, Guinness Brewery.* By S. Geoghegan, before the Institute of Mechanical Engineers. Gives a full description, with detailed drawing, of the rolling stock and tramways at a brewery in Dublin. *Engineer*, Aug. 31, 1888.
- , *Swedish.* By W. Koersner. Treats of the railroads of Europe, but more especially with the development of the railroads in Sweden. Maps and tables of revenues, etc. *Engineering*, Jan. 6, 1888.
- , *Wheel Tires and Rails, Wear of.* By Richard Helmholtz. Discusses the wear on wheel-tires and rails on curves, and rolling stock appliances for reducing the same. *Zeitschrift des Vereines deutscher Ingenieure*, 1888, pp. 330-353; abstracted *Proc. Inst. C. E.*, pp. 549-554.
- Railway on Suspended Cables.** *Annales des P. and C.*, November, 1887.
- Railroad Bed for Bridge Structures.** Abstract of a paper by O. C. Woolson, before the Philadelphia meeting of the American Society of Mechanical Engineers, describing an elastic floor system which has been tried on the elevated roads of New York. Illustrated. *Trans. Amer. Soc. Mech. Engrs.*, Vol. IX. (1888), pp. 276-285; *R. R. Gazette*, Dec. 30, 1887.
- Railroading, Scientific.** By Gen. J. H. Wilson. Reviews the present position of railroading as a science and enters a plea for a good railroad school. *R. R. Gazette*, Dec. 30, 1887.
- Railroad Construction.** Gives a list of all railroad lines in United States, Canada and Mexico, on which track was laid during 1887, with a two-page map printed in colors, showing track laid from beginning of 1886 to June 15, 1888. *Engin. News*, June 16, 1888. See also Tabulation in *Railroad Gazette*, June 1 and 8, 1888.
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- , *Field Practice in the West.* By Willard Beahan. A valuable paper on the methods of location from the standpoint of a chief of a locating party. *Jour. Assoc. Engin. Soc.*, June, 1886, Vol. VII, pp. 196-201; *R. R. Gazette*, May 12, 1888; *Sci. Am. Supple.*, June 23, 1888.
- , *with Taper Curves.* By Frank Olmsted. Gives method of locating curves with tapering ends. *Eng. News*, July 21, 1888.
- Railroad and Waterways, Relative Advantages of, in Germany.** By M. Todd. A valuable paper giving statistics relative to the quantities of goods carried in Germany by rail and by water, ratio of tons to population, etc.; also discusses the relative advantages of the railroads and waterways. Translated from the *Bulletin du Ministère des Travaux Publics* for the *Journal of the Royal Statistical Society*, July, 1888; abstracted *Jour. Soc. Arts*, Aug. 31, 1888.
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- , *Improved Street Car.* Describes the types of rails in use for street car traffic abroad. Illustrated. *Eng. News*, May 12, 1888.

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- , *Specifications for Steel.* By R. W. Hunt, before the American Institute of Mining Engineers. Gives specification for the manufacture of steel rails, embracing the conclusion derived from twenty years' practice in the manufacture of steel. *Eng. and Min. Jour.*, Oct. 27 *et seq.*, 1888; *R. R. Gazette*, Oct. 26, 1888.
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- , *Tests Applicable to.* By James E. Howard. Discusses some of the simple methods of testing rails, and the relative behavior under these tests with the more elaborate ones requiring special machinery. *R. R. Gazette*, Sept. 7, 1888.
- , *85-lb. Standard.* Gives drawing with full dimensions of the 85-lb standard-rail of the Pennsylvania Railroad. *R. R. Gazette*, April 6, 1888.
- , *90-lb. Philadelphia & Reading.* Gives drawing, with full dimensions, of the 90-lb. rail being placed on the Philadelphia & Reading Railroad. *R. R. Gazette*, Aug. 24, 1888.
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- , *Amount Available for Water Supply.* A paper by Desmond Fitzgerald, with discussion. Gives much observed data in vicinity of Boston. *Jour. New Eng. W. Works Asso.*, September, 1886.
- , *Water Level and, of the Great Lakes.* Gives diagram showing the fluctuations of the water-surface, areas, etc., of the Great Lakes, with comments on the phenomena observed. *Engin. News*, Oct. 6, 1888.
- Refrigerating Machines on Board Ship.** By T. B. Lightfoot. Gives early history of refrigerating machines and then describes in detail special machines for use on board of ships. *Trans. Soc. Engrs.*, 1888, pp. 105-124.
- Refrigerating Machinery, Str. Fifehire.** Illustrated description of the most powerful refrigerating machinery ever put in a ship. It uses compressed air, and is to cool 84,000 cubic feet of space. *Engineer*, Oct. 14, 1887; *Sci. Am. Supple.*, Dec. 3, 1887.
- Reservoir, Athens, Ga.** By C. H. Ledlie, before the Engineers' Club of St. Louis. Gives details of the construction of an earthen dam for the Athens, Ga., water-works. *Jour. Assoc. Eng. Soc.*, April, 1888; *Eng. News*, May 5, 1888.
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- , *Nashville, Tenn.* By H. De B. Parsons. Gives a brief description, with plan and sections of wall, of the new storage reservoir being constructed at Nashville, Tenn. *Engin. News*, June 16, 1888.
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- No. 4, Boston Water Supply, by W. F. Learned, together with the methods used for the mixing and handling of concrete. Illustrated. *Jour. New Eng. W. Wks. Assoc.*, December, 1887.
- Reservoir, Vyrnwy, Gauging at.** See River Gauging.
- By Samuel McElroy, before the American Water-Works Association. Contains experience in construction of the Ridgewood reservoir. *Proc. Am. Water-Works Assn.*, Vol. VIII. (1888), pp. 72-77.
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- Retaining Walls.** An attempt to reconcile theory with practice. By Casimer Com stable. *Trans. Am. Soc. C. E.*, Vol. III., pp. 67-75.
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- By Samuel McElroy. Gives practical notes on the construction of retaining walls. *R. R. Gazette*, Nov. 9, 1888.
- , *Methods of Calculating and Designing.* By C. P. Karr. A series of articles following the methods of Dr. Weyrauch and Prof. Rankine, with additional examples from the French practice. *Building*, Dec. 17, 1887, *et seq.*
- River and Harbor Works in Northern France.** By L. Schrader. Interesting description of the works on the lower Seine and Seine, and of the harbors of Nantes, St. Nazaire, Rouen and Havre. *Zeitschr. d. Oester. Ing.- u. Arch-Vereins*, 1887, pp. 130-154.
- Rivers and Harbors, Improvements of.** See Public Works.
- River Gauging at Vyrnwy Reservoir.** By J. H. Parkin, before the Students Institution of Civil Engineers. Gives details of the gauging to determine the daily discharge of the Vyrnwy River. *Proc. Inst. C. E.*, Vol. XCII., pp. 353-367.
- River Improvement in Bavaria.** An illustrated article condensed from the *Journal of the Austrian Society of Engineers and Architects*, No. 43, 1887. Shows method of constructing embankment, shore protection and dikes. Gives rule for the proper proportion of depth and width of channel at lowest water line. *Eng. News*, March 17, 1888.
- *on the Atlantic Coast.* By Wm. P. Craighill, before the annual convention of the American Society of Civil Engineers. Gives description of the treatment of several of the tidal rivers of the Atlantic Coast, with comments thereon. *Engin. and Build. Rec.*, Aug. 11, 1888.
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- Riveted Joints.** Details of tests of 96 specimens of O. H. steel plates, 12 specimens of rivet metal, and of 154 riveted joints made at the Watertown Arsenal in 1885. Report for that year, Ex. Doc., No. 36, 49th Congr., 1st Session.
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- Road Material of Ohio.** By Ed. Orton. Describes the stone in Ohio available for road-making material. *Rpt. Ohio Soc. Surv. and Engrs.*, 1888, pp. 60-68.
- Road Metal and Paving Setts, Valuation of.** By W. F. K. Stack. Discusses the proper method of testing road-making material, and gives details of tests made on duration by means of a machine. Illustrated. *Engineer*, Aug. 31, 1888.
- Rolling Mill, Universal.** Gives description of Sacks' improved universal rolling mill, adapted to rolling double angle, star, H. T., and similar sections. *Sci. Am. Sup.*, Jan. 7, 1888.
- Rolling Stock.** See Railroads, Cars, Locomotives and Axles.
- Roof Truss.** A brief description with full detailed drawing of main roof trusses of the station of the South Brooklyn Railroad and Terminal Company. The trusses have a span of 147 feet, rise of 30 feet, and 27 feet effective depth. *Engin. and Building, Rec.*, March 17, 1888.

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- , *Cantilever.* Gives details of a cantilever roof erected by the Berlin Bridge Co. over their girder shop. *Engin. and Build. Rec.*, Aug. 4, 1888.
- , *Depot of the Central Railroad of New Jersey.* Gives plan and elevation of the new depot of Jersey Central Railroad at Communipaw, etc., also half-section showing roof truss, with dimensions. Its span is 142 feet. *Engin. News*, October 6, 1888.
- , *Paris Exhibition.* Description, with elevation and details, of the roof truss over the Fine Arts Court at the Paris Exhibition, 1889. *Engineer*, Sept. 2, 1887; also Sept. 16.
- , *Paris Exhibition.* A two-page plate showing details of roof truss and other iron work of the galleries of miscellaneous exhibits at the Paris Exhibition of 1889. *Engineering*, Dec. 30, 1887.
- , *Phoenix Bridge Co.* Gives short description, with general plans, elevation diagrams and details of the roof trusses of the new girder shop of the Phoenix Bridge Works. *Eng. and Build. Rec.*, April 7, 1888.
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- Sanitation of Towns.** By J. Gordon. A presidential address before Society of Municipal and Sanitary Engineers and Surveyors of England. *Sci. Am. Sup.* Nov. 19, 1887.
- Section Lining, Standard.** By T. Van Vleck. Recommends the adoption of standard section to represent the conventional sections of iron, steel, etc., on all engineering drawings. Cuts show the proposed sections. *Eng. News*, Dec. 31, 1887.
- Sewage, Chemical Treatment of Mystic.** By W. T. Learned. Before the Boston Society of Civil Engineers. Gives results of a study of the chemical treatment of Mystic sewage. Precipitant used was crude sulphate of alumina. *Jour. Assoc. Eng. Soc.*, July, 1888, Vol. VII., pp. 244-248.
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- , *Disposal.* By C. A. Allen, before the annual convention of the American Society of Civil Engineers. Gives a brief review of the history of sewage purification in England, and a review of the different methods employed at present. *Trans. Am. Soc. C.E.*, Vol. XVIII., Jan., 1888, pp. 9-23, and a discussion, pp. 24-42.
- , *Disposal at Medfield, Mass.* By Fred Brooks, before the Boston Society of Civil Engineers. Describes the intermittent, downward filtration sewerage system at Medfield, Mass., with map and plans of basins, etc. *19th An. Rep. Mass. Board of Health; Jour. Assoc. Engin. Soc.*, July, 1888, Vol. VII., pp. 235-244; *Engin. and Build. Rec.*, July 16, 1888.
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- Sewerage, Acton.** Brief description of the Acton sewerage works, with ground plan. *Engineer*, Sept. 9, 1887.
- , *Assessment of Costs of.* By T. W. Whitlock, before the Connecticut Association of Civil Engineers and Surveyors. Discusses the proper method of assessing

- property for sewerage improvements. *Proc. Conn. Assoc. C. E. and Surv.*, 1888, pp. 57-62.
- Sewerage.** *Fort of Mysore, India.* By Standish Lee. Gives description, with detailed drawing, of sewerage system at the Fort of Mysore, India. *Indian Engin.*, June 30 *et seq.*, 1888.
- , *Frankfort-on-the-Main.* Gives details of the sewerage scheme being carried out at Frankfort-on-the-Main, with drawing showing details. *Engin. and Build. Rec.*, Aug. 11 *et seq.*, 1888.
- , *Henley-on-Thames.* Gives brief description of the Shone system of sewerage at Henley-on-Thames. *Engineer*, Oct. 21, 1887.
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- , *Southampton, Eng.* An abstract of a paper by W. B. G. Bennett, before the Institution of Civil Engineers. Gives a description and cost of operation of the sewage clarification and house-refuse disposal works at Southampton, Eng., with plans and sections. *Engr. and Build. Rec.*, April 28, 1888.
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- , *Wednesbury.* Gives brief description of the works at Wednesbury. The sewage is treated with sulphate of alumina and lime. *Engineer*, Dec. 16, 1887.
- Sewers.** Gives the decision in the case of the New London sewer assessments. The assessments hold good. *Engr. and Build. Rec.*, March 31, 1888.
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- , *Flow of Air in.* Gives details of experiments by W. E. McClintock on the flow of air in pipe sewers, and its effect on traps at the foot of soil-pipe. *Engr. and Build. Record*, Feb. 11, 1888.
- , *Memphis.* By Rudolph Hering. Gives conclusions arrived at from a recent inspection of the Memphis sewerage system. *San. Engr.*, Nov. 24, 1887.
- Screw Threads, New System of.** Recites objections to systems in use, and proposes a new system giving an increase of strength of 17 per cent. over the Sellers thread. By John L. Gill, Jr., Phila. *Journal Franklin Institute*, March, 1888.
- Shafts, Propeller, for Marine Engines.** Treats of the material from which they are manufactured, investigates the strains and proper proportions. *Mech. World* Dec. 17, 1887.
- Shaft Sinking through Loose Material.** By A. McC. Parker. Gives description with details of the method employed to sink a shaft at the "Tilly Foster" mines *School of Mines Quar.*, Oct., 1887; *Engr. News*, Dec. 3, 1887.
- Signals, Interlocking.** See Railroads.
- Ship Railway, Venetian.** By E. L. Corthell, before the Philadelphia Engineers' Club. Gives an interesting sketch of ship railroad project carried out in Venice in the 15th century. *Proc. Engrs. Club, Phila.*, Dec., 1887, Vol. VI., pp. 153-165.
- Ships, Tonnage of.** A good review of the use of the terms ton and tonnage as employed in maritime commercial transactions. *Engineer*, Dec. 30, 1887.
- Ship Transfer.** *Present Aspect of the Problem of American Inter-Oceanic Ship Transfer.* Read before the Engineers' Club of St. Louis, March 2, 1887, by Robert Moore. A complete and interesting exposition of the subject. *Jour. Assoc. of Engr. Soc.*, February, 1888.
- , By E. L. Corthell. A review of the above paper, and a reply to the review by Robert Moore. *Jour. Assoc. of Engr. Soc.*, May, 1888.
- Sinking Funds.** *Formulæ Derived.* *Jour. New Eng. W. Wks. Assoc.*, June, 1887.

- Siphon, Automatic Intermittent.** Gives a description of a self-priming siphon for sanitary or manufacturing purposes where a periodical flush is required. *Sci. Am. Supple.*, March 31, 1888.
- Skew Arch.** See Arches.
- Slide Rule.** By E. A. Gieseler. Gives description and rules for using this valuable instrument. *R. R. Gazette*, March 9, 1888.
- Snow Sheds, Canadian Pacific Railroad.** Gives description with drawings of the different forms of snow-sheds in use on the Canadian Pacific Railroad. *Engin. News*, Jan. 21, 1883.
- Standard of Length, Wave Length of Sodium as a.** By Prof. A. A. Michelson and E. W. Morly, before the Civil Engineers' Club of Cleveland. Gives a method for making the wave length of sodium light the actual and practical standard of length. *Jour. Assoc. of Engin. Soc.*, May, 1888.
- Steam, Effect of Circulation on.** By G. H. Barrus, before the American Society of Mechanical Engineers. Gives experience in the effect of circulation in steam boilers on the quality of the steam. *Am. Engr.*, May 9, 1888.
- , *Efficiency of High Pressure.* By W. W. Beaumont, before the British Association. Object of paper is to show that Carnot's theorem is limited in its application to the steam engine, and that high pressure steam must theoretically, as well as practically, be more efficient than low pressure. *R. R. Gazette*, Nov. 2, 1888.
- , *Generation of.* By G. H. Babcock. A Sibley College lecture. Treats of the generation of steam in tubular boilers. Illustrates and describes the different boilers with furnaces for burning coal, wood, gas, bagasse, etc. *Sci. Am. Sup.*, Dec. 17 and 24, 1887.
- Steam Engine, Contribution to a Rational Theory of the.** A series of articles intended to supply a description of the phenomena attending the performance of work in a steam engine and certain deductions logically following on the phenomena. *Engineer*, July 6, et seq., 1888.
- , *A New.* By H. Turner. Gives a description of a new form, tandem compound, of steam engine. *Engineer*, July 20, 1888.
- Steam Engineering, Introduction to the Study of.** By R. H. Buel. A series of articles for practical men with a limited education. *Am. Engineer*, May 30 et seq., 1888.
- , *River Practice in the West.* By J. M. Sweeney, before the Nashville meeting of the American Society of Mechanical Engineers. *Am. Engineer*, June 13, 1888.
- Steam Heating.** See Heating Cities by Steam.
- , See Heating.
- , See Car Heating.
- Steam Plant, Station J, New York Steam Co.** Gives a full description of the plant of the New York Steam Company at Station J. Shows plans of building, pipe arrangements, etc. *Engin. and Build. Rec.*, April 7, 1888.
- Steamer, Stern-Wheel.** A description of a stern-wheel steamer, 120 ft. long by 24 ft. 6 in. beam, recently constructed for the navigation of Maddolena River, South America. Plan and elevation. *Engineer*, Sept. 30, 1887; *Sci. Am. Sup.*, Nov. 12, 1887.
- Steel, Basic Siemens Process.** A paper by F. W. Harbord, before the Iron and Steel Works Managers' Institute, giving a description of the Basic-Siemens process of making steel. *Mech. World*, Dec. 31, 1887; *Engineering*, Dec. 16, 1887; *Am. Manuf.*, Jan. 6, 1888. A description of the Batho furnace to employ this process will be found in the same number of *Am. Manuf.*
- , *Bessemer, Modifications of the Process.* Abstract of a lecture before the Franklin Institute, Jan. 3, 1887, by C. Hanford Henderson. Treats especially of the Clapp-Griffiths and the Thomas and Gilchrist methods. *Journal of the Franklin Institute*, June, 1887, Vol. CXIII, No. 738.
- , *Bridge, Discussion on.* Gives a discussion on bridge steel that took place at an Edinburgh meeting of the Iron and Steel Institute. *R. R. Gazette*, Sept. 14, 1888.
- , *Compressive Strength of Iron and.* By C. A. Marshall. Gives results of a large number of tests made to discover the relation which compressive strength

bears to tensile strength. *Trans. Am. Soc. Civ. Engrs.*, Vol. XVII., pp. 53-110 (August, 1887).

Steel, as flooring. See Flooring.

— *Direct from the Ore.* By F. L. Garrison, before the Boston meeting of Mining Engineers. Gives the results of investigation of the attempts to produce steel direct from the ores. Describes in detail the development of Hasgafael's improved high bloomary (a modification of the old Stackofen process) for the production of iron and steel direct from ores. Illustrated. *Am. Manuf.*, April 6, 1888.

— *Effect of Temperature upon Structural Iron and Steel.* By Jos. Ramsey before the Engineers' Society of Western Pennsylvania. Gives the results of some tests and investigations. *Eng. News*, Dec. 3, 1887.

— *Fifteen Years of Open-Hearth Experience.* By W. E. Kock before the Engineers' Society of Western Pennsylvania. Traces the development of the open-hearth process, and gives much interesting information concerning the use and working of steel. Abstracted *Engin. and Build. Rec.*, May 19, 1888, and *Engr. News*, June 9, 1888; *Am. Engr.*, June 27, 1888; *R. R. Gazette*, Aug. 17, 1888.

— *Improvements in Open-Hearth Practice.* By A. E. Hunt, before the Boston meeting of the American Institute of Mining Engineers. Gives a good description of the process of making wrought iron direct from the ore employed by the Carbon Iron Company at Pittsburgh. *Eng. News*, March 24, 1888.

— *Influence of Copper on Tensile Strength.* A paper prepared by E. J. Ball and A. Wingham for the Iron and Steel Institute. Gives results of experiments made to ascertain the effect of copper on the tensile strength of steel and iron. It appears to render them extremely hard. *Amer. Manufacturer*, Sept. 28, 1888.

— *Its Properties, Its Use in Structures and Heavy Guns.* By Wm. Metcalf, before the American Society of Civil Engineers. A valuable contribution on steel, and a plea for the Rodman gun. Discussion covering 90 pages. *Trans. Am. Soc. C. E.*, Vol. XVI., pp. 283-389, June, 1887. Abstracted in *R. R. Gazette*, March 18, 1887; *R. R. and Eng. Jour.*, April, 1887; *Am. Engineer*, April 6 and 13, 1887.

— *Manganese.* By R. A. Hadfield, before the Institution of Civil Engineers. Two papers, "Manganese in its Application to Metallurgy," and "Some Newly Discovered Properties of Iron and Manganese." Iron with from 2.75 to 7 per cent. of manganese is very brittle; between 7 and 20 per cent. of manganese give a very strong and tough material, specimens of which broke with a tensile strain of 65 tons and showed an elongation of 50 per cent. *Proc. Inst. C. E.*, Vol. XCIII., pp. 1-108; abstract *Engineering*, March 9, 1888; *R. R. Gazette*, March 30 and Sept. 7, 1888; *Sci. Am. Supple.*, April 7, 1888; *Mech. World*, March 10, 1888; *Engineer*, March. 16, 1888; *Am. Manuf.*, April 6, 1888; *T. J. and Elec. Rev.*, Aug. 10, 1888; *Master Mechanic*, October, 1888.

— *Plate Building.* See Buildings.

— *Open-Hearth for Boilermaking.* By H. Goodall, before the Institution of Civil Engineers. The paper gives the experience of the author in the use of open-hearth steel for boilermaking since 1875, and describes numerous experiments to ascertain the cause of difficulties met with in working the plates. *Proc. Inst. C. E.*, Vol. XCII., pp. 2-72; abstract in *Engineering*, Jan. 13, 1888; *Mech. World*, Jan. 24, 1888.

— *Results from Tests made shortly after Rolling.* By E. C. Felton, before the Philadelphia meeting of the American Society of Mechanical Engineers. Gives notes on the results of a large number of tests made to determine the effects of tests of steel shortly after the rolling. *Trans. Am. Soc. Mech. Engrs.*, Vol. IX. (1888), pp. 38-50.

— *Tests of the New Direct Process Open Hearth.* Gives results of tests made by G. H. Thomson of the new direct process open-hearth steel, of the Carbon Iron Co. made at the shops of the Union Bridge Co. It stood severe tests, and bids fair to become an important production. *Engin. News*, Jan. 21, 1888.

— *Use of Aluminum Alloys in Making.* A discussion by the Engineers' Society of Western Pennsylvania on the use of aluminum alloys in steel making. *R. R. Gazette*, May 11, 1888.

Steel Cables. See Cables.

Steel Tapes, Use of, in Surveying. By J. B. Johnson, before the Ohio Society of Surveyors and Civil Engineers. Discusses the different errors and their effects; the limits of error; standardizing tapes, etc. *Engr. News*, March 3 and 10, 1888.

- Steelworks, Terni, Machinery for the.** By H. Savage, before the Institute of Civil Engineers. Gives description of the plant at the new Terni, Italy, steelworks. *Proc. Inst. C. E.*, Vol. XCIII., pp. 390-404.
- Stand Pipes.** See Water Supply.
- Stone Arches.** See Arches.
- Storage Batteries for Electric Locomotion.** By A. Reckenzaun. A paper read before the Electric Light Association. Gives historical facts and working figures of expense, etc. *Sci. Am. Supple.*, Nov. 5 and 19, Dec. 24, 1887.
- . See Batteries.
- Strains in a Cast-Iron Disk.** By G. Leverich before the American Society of Civil Engineers. Gives details and results of an investigation to determine the strains in a cast-iron hollow disk cut from the sinking head of a casting of a Rodman gun. *Trans. Am. Soc. C. E.*, Vol. XVIII., Feb., 1888, pp. 43-50.
- in *Highway Bridges.* See Bridges.
- in *Iron and Steel, Permissible.* *Annales des P. and C.*, December, 1887.
- Street Railroads.** An illustrated description of the Mekarski compressed air car, several of which are now working on a London road. *Engineering*, March 23, 1888.
- . See Electric Railroads and Elevated Railroads.
- Strength of Materials. Z-Iron Columns.** By C. F. Strobel before the American Society of Civil Engineers. Gives details of the tests of 15 columns of Z-iron. Abstracted *R. R. Gazette*, July 13, 1888.
- Stress, Elevation of the Limit of.** A paper describing a series of experiments to determine facts in regard to the operation of the law called the elevation of the limit of stress, with miscellaneous experiments to determine physical phenomena accompanying rapid alternation of strain and rest. *Report of U. S. Board of Testing, etc.*, Vol. 1, 1881, pp. 107-121.
- Struts, Stiffness of.** Gives results of experiments made at Mason College to investigate the influences of variation of load, of length, and of eccentricity of thrust from centre of end section. *Engineer*, Jan. 6, 1888.
- , *Working Strength and Stiffness.* By Prof. W. H. Smith. *Engineer*, Oct. 14 and 28, 1887.
- Subway, Proposed New York.** Gives substance of a report to the Commissioner of Public Works of New York as to feasibility and cost of removal to subways under sidewalks of all pipes, conduits, wires, etc., now buried under street pavements. *Eng. and Build. Rec.*, Aug. 4, 1888.
- Surveys, Exterior Boundary of Townships.** By Z. A. Enos. Discusses whether the exterior boundary line of a township, as first run or as modified by subdivisional lines and corners, is to be regarded the true boundary line. *Rep. Ill. Soc. Engrs. & Surv.*, 1888, pp. 90-101.
- , *New Jersey State.* An extract from the Report of the State Survey of New Jersey, describing the work done and the manner of preparing the results for publication. *Eng. News*, April 14, 1888.
- , *Outfit for Railroad.* By Benj. Thompson. Gives description of the outfit of a railroad surveying party, and tells how the work was done. *Rept. Ohio Soc. Surv. and Engrs.*, 1888, pp. 237-244.
- , *State.* By Charles C. Brown. Discusses the need of state surveys and gives the cost of such work in different states. *Jour. Assoc. of Eng. Soc.*, May, 1888.
- . See Railroad Location.
- Surveying, Plane Table.** By Josiah Pierce, before the Institution of Civil Engineers. Discusses the economic use of the plane table in topographical surveying, with discussion. *Proc. Inst. C. E.*, Vol. XCII., pp. 187-256.
- , *Use of Stadia in Railroad.* By J. B. Johnson. A series of articles showing how the stadia rods may be used with advantage in preliminary railroad surveys. *R. R. Gazette*, Feb. 3 et seq., 1888.
- Surveying and Geodesy, Literature of,** for the year 1886, by R. Gerke. A complete list of books and papers on these subjects for 1886. Valuable for those desiring to keep posted on this subject. *Zeitschr. f. Vermessungswesen*, 1887, pp. 475-502, 514-519.
- Switch, Standard Point B. & A. R. R.** By C. E. Alger. Gives plan and details of the point switch in use as the standard of the Boston & Albany Railroad. *R. R. Gazette*, March 2, 1888.
- . See Railroads.

Switchback. *Stampede Pass, N. P. R. R.* A description with plans and profiles of the temporary switchback of the Northern Pacific Railroad over the Cascade Mountains at Stampede Pass. *R. R. Gaz.*, Dec. 23, 1887. For details of method of running trains over this switchback see *R. R. Gaz.*, Jan. 13, 1888.

—, By H. S. Huson. Gives reasons for its construction, and details of location, track and locomotives, etc. *R. R. Gazette*, Feb. 3, 1888.

Telescopes for Stellar Photography. By A. Grubb, before the Society of Arts. Describes the telescopes to be used in the proposed international survey of the heavens. *Jour. Soc. Arts.*, April 20, 1888.

—, *Great, of the World.* By J. K. Rees, before the New York Academy of Science. Gives a popular account of the great telescopes of the world, and discusses their construction, powers and future prospects. *Sci. Am. Supple.*, March 3, 1888.

Toredo Navalis, or Ship Worm. By G. W. R. Bayley. Gives the experience with the teredo navalis on the bridge piling and foundation of a railroad from New Orleans to Mobile. *Trans. Am. Soc. C. E.*, Vol. III., pp. 155-171.

Testing Machine, Cement. Drawings of the cement testing machine in use at Poughkeepsie bridge. *Engr. and Build. Rec.*, Jan. 21, 1888.

Testing, Material. Gives the tests that material supplied for locomotives on the Missouri Pacific Railroad must stand. *Nat. Car and Loco. Builder*, December, 1887.

—, *Strength of Engineering Material.* By Prof. J. B. Johnson. Gives summary of the present state of knowledge relating to certain materials and indicates how tests may be made useful in designing. *Jour. Asso. Eng. Soc.*, Vol. VII., pp. 92-101, March, 1888.

Tests. Alloys. See Alloys.

—, *Impact on Iron.* A paper describing a series of impact tests upon various irons, with illustrated description of the hammer and method of use; tabulated details of tests and physical phenomena observed during the work. *Report of Board of U. S. Testing, etc.*, 1881, Vol. I., pp. 122-146.

—, *of Wood Treatment.* Gives details of tests to ascertain the relative life and value of wood treated with various antiseptics and untreated timber in resisting the ravages of the teredo. *Engin. News*, Sept. 1, 1888.

—, *Steam. Report of the Steam Engine Tests* made at the Franklin Institute Electrical Exhibition at Philadelphia in 1884. Very complete tests of Porter-Allen, Southwark and Buckeye engines. *Journal of the Franklin Institute*, February, 1886, Vol. CXXI., No. 722.

—, See Governor, the Ball.

Test Pieces, Incorrectly Proportioned. A paper showing the errors in estimating results of tension tests due to the use of incorrectly proportioned test pieces. *Rep. U. S. Board of Testing*, Vol. I., pp. 91-104.

—, *Forms and Proportions of.* A paper showing by experiment the correct form and proportions of test pieces to procure correctly the tenacity, elastic limit, etc., of various metals. *Report of U. S. Board on Testing, etc.*, 1881, Vol. I., pp. 91-105.

Thermo-Magnetic Generator and Motor. Gives an illustrated description of the Menges generator and motor, designed for the more direct conversion of heat into electricity. *Sci. Am. Supple.*, Feb. 18, 1888.

Ties, Steel. See Railroads.

—, *Metallic.* Gives figures showing the cost of maintenance of track laid with metallic ties. *R. R. Gaz.*, Dec. 16, 1887.

Timber, Creosoting in New Zealand. By Wm. Sharp, before the Institute of Civil Engineers. Gives description of the first plant erected in Australasian colonies for creosoting timber; also gives specimens of 50 creosoted sleepers. *Proc. Inst. C. E.*, Vol. XCIII., pp. 408-420.

—, *Dry Rot in.* By W. H. Bidlake. A report presented to the Science Standing Committee of the Royal Institute of British Architects. It is based upon 17 cases of dry rot. *R. I. B. A. Journal*, June 14, 1888; *Engin. and Build. Rec.*, July 14, 1888.

—, *Its Diseases.* A paper by Marshall Ward giving a full discussion of the growth of timber and its diseases, with an investigation of the causes of decay. *Sci. Am. Supple.*, March 17 et seq, 1888.

- Torpedo-Boat, "Fatum."** A brief description of the station torpedo boat "Fatum," with two-page plate showing plans, elevations and cross-sections. *Engineering*, Jan. 20, 1888.
- Torpedo, Howell's.** Gives a full comparison of the Howell with the Whitehead and Brennan torpedo. Shows the Howell to be the best. *Engineering*, Jan. 20, 1888.
- Tow-Boat Operated by the Current to Tow Vessels Up-Stream.** *Annales des P. and C.*, November, 1887.
- Town Refuse, Destruction of.** By Thomas Codrington. Gives a report on the different methods in use for destroying town refuse. Contains large amount of data relating to refuse. Abstracted *Eng. and Build. Record*, Sept. 15, 1888.
- Track Maintenance.** See Railroads.
- Tramway, Compressed Air.** A review of the Vincennes-Ville Evrard compressed air tramway, which has been in operation for nine years. Illustrated. *Sci. Am. Supple.*, March 17, 1888.
- , *Electric, Bessbrook and Newry.* By E. Hopkinson, before the Institute of Civil Engineers. Describes the construction and discusses the working of the Bessbrook and Newry electrical tramway, designed for freight and passenger traffic. Gives full details. Experiments show the electrical efficiency to be 72 per cent. *Engineer*, Dec. 16; *Engineering*, Dec. 9, 1887. Abstract in *R. R. Gazette*, Feb. 24, 1888.
- Train Service, American and Foreign.** By A. T. Hadley. Gives a comparison of the train service in the different countries. Shows the average frequency of trains and the proportion between train service and population. *R. R. Gaz.*, Nov. 25, 1887.
- Transit Notes, Best Method of Keeping.** Gives a number of articles on the best method of keeping transit notes of curves. *Engin. News*, Sept. 22, *et seq.*
- Transformers, Alternate Current.** By Gisbert Kapp, before the Society of Telegraph Engineers and Electricians. Gives a full treatment of alternate current transformers, with special reference of the proportion of iron and copper. A valuable paper. *Tel. Jour. and Elec. Rev.*, Feb. 18 *et seq.* 1888; *Engineer*, Feb. 10 *et seq.*; *Engineering*, Feb. 16 *et seq.*, 1888; *Electrical World*, March 17, 1888.
- Transmission of Power, Compressed Air.** By Prof. W. C. Unwin. States in a simple form the laws governing the transmission of power by compressed air. *Proc. Inst. C. E.*, Vol. XCIII., pp. 421-436.
- , *Electrical.* By Prof. Ayrton, before the Bath meeting of the British Association. Discusses the advantages of electrical transmission of power, and tells what is being done. *T. J. and Elec. Rev.*, Sept. 21, 1888; *Am. Eng.*, Oct. 3 *et seq.*, 1888.
- , *Electrical.* Gives details of the experiments made in November, 1886, at the Oerlikon Works at Zurich. The dynamos were about 50 horse-power, and were to be used over a distance of five miles. Illustrated. *Engineer*, April 13, 1888.
- , *Electrical.* Gives results of the electrical transmission of work from Kriegstetten to Solothurn. Is described by Prof. H. F. Weber, Reporter to the Commission of Measurement. *Tel. Jour. and Elec. Rev.*, Feb. 17. *et seq.*, 1888; from the *Schwartz Bauzeitung*, Vol. XI., Nos. 1 and 2; condensed account in *Sci. Am. Supple.*, March 3, 1888.
- , *Electrical.* Gives further tests of the electrical transmission of a water-power of 50-horse maximum by four Brown dynamos at Kriegstetten, Switzerland. *Engineering*, April 20, 1888.
- , *Hydraulic.* See Power.
- , Gives illustrated description of the method of rope transmission adopted in the boiler shops of the Southern Railroad of France. *R. R. Gaz.*, Jan. 13, 1888.
- Trestles, Cluster Bent.** By J. A. Hanlon. Gives details of a high trestle near Flushing, O., constructed on the cluster bent plan; shows plan and cross-sections. *Engr. News*, Dec. 31, 1887.
- , *Standard Plans.* Give plans and details of the standard pile trestle in use on the Chicago, Burlington & Northern Railroad. *Engr. News*, June 9, 1888.
- Trestle Work, Special Features in Wooden.** Discusses the use of mortise and tenon-cap bolting, end bearings, etc. *Engin. News*, July 21, 1888.
- Triangulation.** The field operations of the primary triangulation of the Prussian survey. By Erfurth. General description, outfit, signals. *Zeitschr. f. Vermessungswesen*, 1887, pp. 377-383, 421-437.

- Tunnel, Alignment of Nepean, N. S. W.** By T. W. Keele before the Institution of Civil Engineers. Gives details of the alignment of the Nepean Tunnel for the Sidney water supply, New South Wales. Length of tunnel, 23,507 ft., $7\frac{1}{2}$ ft. high, and $9\frac{1}{2}$ ft. wide. Error in alignment for 4,341 ft. was $\frac{5}{8}$ in., and in levels, $\frac{1}{4}$ in. *Proc. Inst. C. E.*, Vol. XCII., pp. 259-267.
- , *Coosa Mountain*. Gives brief description, with section, of the tunnel on the Columbus & Western R. R., near Birmingham, Ala. Length, 2,434 ft.; width, 16 ft., with centre height of $21\frac{1}{2}$ ft. *R. R. Gazette*, Aug. 3, 1888.
- Tunnel, New Croton Aqueduct.** Gives details of the meeting of the headings of the tunnel. *San Engr.*, Nov. 26, 1887.
- , *Proposed Simplon*. Gives brief review of the history and merits of the proposed Simplon Tunnel between Switzerland and Italy. Illustrated with profiles and plan. *R. R. Gazette*, Aug. 17, 1888.
- , *Vosburg, Construction of the*. A pamphlet of 56 pages, with plates showing sections of the tunnel at various stages, systems of timbering, drilling, firing, etc., and letter-press giving details of construction, cost, etc. Address the author, L. Von Rosenburgh, 35 Broadway, New York. Abstracted in *Engineering*, April 6, 1888.
- Tunnels, Bottom or Top Heading in.** By C. L. Kalmbach. Discusses the use of top heading and advocates the use of bottom heading. Illustrated. *Engr. News*, March 24, 1888.
- Tubes. Rolling Seamless Tubes from Solid Ingots.** By Frederic Siemens before the Bath Meeting of the British Association for the Advancement of Science. Describes the Mannesmann process of rolling seamless steel tubes from a solid ingot. *Amer. Eng.*, Oct. 10, 1888.
- , *Seamless Tubes made from Solid Blanks*. A novel method of making a tube from a solid ingot by passing it between rolls described and illustrated. *American Machinist*, Oct. 15, 1887; *Sci. Am. Supple.*, March 24, 1888; *R. R. Gazette*, Oct. 17, 1887, and *Engineer*, Nov. 11, 1887.
- Turbine, Compound Steam.** Gives a description and discussion of a motor composed of a series of 45 turbines acted upon by a current of steam. *Sci. Am. Supple.*, Feb. 18, 1888.
- Turbines, Terni Steel Works.** Gives illustrated description of turbines at the steel works of Terni, Italy. *Engineer*, Sept. 23, 1887.
- Turn-Tables. Indian Railroads.** Gives drawings, in detail, with dimensions for the turn-tables to be used on the Indian State Railroads. *Engineer*, Oct. 28, 1887.
- Viaduct, Approach and Terminus, Montreal.** A brief illustrated description of the masonry approach and terminus of the Canadian Pacific Railroad at Montreal. Also shows the cost of maintaining an iron and masonry viaduct. *Engin. News*, March 3, 1888.
- , *New Tay*. By S. S. Kelsey, before the Institution of Mechanical Engineers. Gives full description of the new Tay viaduct and some of the methods employed in its erection. *Engineer*, Sept. 2, 1887.
- , *Stanucca, N. Y., L. E. & W. R. R.* Gives details of the Stanucca viaduct on the New York, Lake Erie & Western Railroad, taken from an old letter book of its designer, Mr. J. W. Adams. *Engin. News*, Sept. 1, 1888.
- Voltmeters, Portable, Ayrton and Perry's.** These instruments are an improvement upon the Cardew voltmeters, and depend upon the expansion of a fine wire due to the heating effect of a current. *Electrical World*, Jan. 28, 1888.
- War Ships, American.** By W. John, before the Institution of Naval Architects. Gives description of a competitive design which was accepted by the U. S. Naval Department. *Engineering*, March 30, 1888.
- Washouts, Their Prevention and Treatment.** By W. B. Parsons. Shows what can be done to prevent washouts, what to save damage during their occurrence, and especially what is to be done after they have taken place. *R. R. Gazette*, April 20, 1888.
- Watches, Magnetism in.** By C. K. Giles, before the Alexandria Bay meeting of the American Railway Master Mechanics' Association. Gives the results of four years investigation of the effect of magnetism in watches. *Master Mechanic*, Sept., 1888.
- , *Paillard's Non-Magnetic Compensating Balances and Hair-Springs for*. By Prof. Edwin J. Houston. Describes Paillard's non-magnetic watches, gives com-

- position of alloys used, and results of careful tests of the watches. A distinct advance in the construction of accurate timepieces. *Journal of Franklin Institute*, March, 1888.
- Watches.** *Protection of Watches against Magnetism.* Also, a convenient method of demagnetizing. Paper by Dr. P. Lange, read before the National Electric Light Association, Pittsburgh. *Electrical Engineer*, March, 1888; *Electrical World*, March 3, 1888.
- Water Aeration and Filtration.** Paper by Charles B. Brush, with discussion. Many new and pertinent facts presented, especially in the discussion by Dr. Leeds. *Jour. New Eng. W. Works Asso.*, September, 1887.
- Water Analysis for Railroads.** A paper by George Gibbs before January meeting Western Railroad Club. Discusses the subject from a practical standpoint and gives the experience of the C., M. & St. P. R. R. Gives method of gathering data, results of analysis, etc. *Master Mechanic*, February, 1888.
- , *Mississippi River.* Abstract from the report of Dr. Charles Smart, giving the result of a series of analyses made for the State Board of Health of Minnesota of the waters of the Mississippi River and some of its tributaries. *Eng. and Build. Record*.
- Water, Action of Boston, on Service Pipes.** By Wm. R. Nichols and L. K. Russell. Gives details of experiments made to discover the amount of zinc taken up from galvanized iron water pipes. Results show that the zinc coating is slowly but continuously dissolved. *Jour. Assoc. Engin. Soc.*, January, 1888, pp. 12-14; *Engin. News*, February, 1888; *Sci. Am. Supple.*, March 3, 1888; *Eng. and Build. Rec.*, March 31, 1888; *Abstracted Proc. Inst. C. E.*, Vol. XCIII., p. 480.
- , *Consumption and Capacity* in thirty cities and towns for the year 1886. *Jour. New Eng. Water-Works Assoc.* for March, 1888.
- , *Clark's Process of Softening.* An editorial giving a summary of a long correspondence on the softening of water by the Clark process. *Engineer*, Oct. 21, 1887.
- , *Discharge of.* See Flow of Water.
- , *in "Great Ponds." To Whom Does it Belong?* The question argued in favor of the public, as against the riparian owners below. *Jour. New England Water-Works Assn.*, Dec., 1886.
- , *in Japan. A Description of Japanese Water Supply Systems.* By Prof. W. S. Chaplin. *Jour. New England Water-Works Assn.*, Dec., 1886.
- , *Pollution of Air and.* By A. E. Fletcher, before the Society of Arts on the present state of the law concerning the pollution of air and water. Shows what the law has done, and what is still hoped for from its further action. *Jour. Soc. Arts*, April 13, 1888.
- , *Softening.* Two articles, showing how to accurately determine the degree of hardness of water, and by what means it has been proposed to artificially soften it for domestic use. Discusses the Porter-Clark, Stanhope Company's and the Anti-Calcaire processes. *Engineer*, Feb. 3 and 10, 1888.
- , *The Odor and Color of Surface Waters.* A most excellent paper and valuable discussion before the New England Water-Works Association. By Prof. Thos. M. Drown. Gives methods of determination and results of the official examination of the potable waters of Massachusetts, the whole covering 27 pages in the *Jour. New Eng. W. Wks. Asso.*, March, 1888.
- Water Gas, as applied to Metallurgical Processes.** By A. Wilson, before the Iron and Steel Institute. Describes the modifications of Lowe and Strong's process developed at Essen, and its application to heating purposes and steel melting at Wilkowitz, Terni, etc. *Am. Manuf.*, June 8, 1888.
- Water Hammer, a Discussion,** giving the experience of water-works superintendents. *Jour. New Eng. W. Works Assoc.*, Sept., 1886.
- Water Mains, Cleansing.** By J. H. H. Swiney, before the Institution of Civil Engineers. Gives details of the cleansing of the water mains at Omagh. The pipe was coated with about one inch of peat. Scrapers were sent through the pipe. *Engineering*, April 13, 1888.
- , *Detection of Leaks in.* By Joseph Francis. *Engineer*, July 13, 1888.
- , *Draining and Filling.* By S. B. Russell, before the Engineers' Club of St. Louis. Discusses the precautions that should be taken in draining and filling

- water-mains. *Jour. Assoc. Engr. Soc.*, Vol. VI., 1887, pp. 298-305; *San. Engr.*, Dec. 24, 1887.
- Water Meters.** A discussion covering 11 pages in the *Jour. New Eng. W. Works Association* for September, 1886.
- Water-Meter, Venturi.** By Clemens Herschel, before the American Society of Civil Engineers, giving details of experiments made with a meter, embodying the property of Venturi tubes, applied to pipes from one to nine feet in diameter. Eight plates. *Trans. Am. Soc. C. E.*, Vol. XVII. (November, 1887), pp. 228-258; abstracted *Prac. Inst. C. E.*, Vol. XCIII., pp. 515-516; abstracted in *San. Engr.*, Dec. 24, 1887.
- Water-Meters. Recent Tests at Boston.** By L. F. Ries, before the Boston Society of Civil Engineers. Gives details of the methods and apparatus used in "making a full test and report" upon the merits of water-meters for the Boston Water Board. *Jour. Assoc. Engrs. Soc.*, August, 1888, Vol. VII., pp. 285-297.
- *System of, Providence, R. I.* By E. B. Weston, before the Boston Society of Civil Engineers. Gives details of the management of the water meter system at Providence, R. I., where 58 per cent. of the consumers have meters. *Jour. Assoc. of Engrs. Soc.*, August, 1888, Vol. VII., pp. 297-304; *Engr. News*, Aug. 11, 1888.
- Water Motor,** which works automatically in a supply pipe to a reservoir, with 5 pounds pressure, whether towards or from the reservoir, pumping a percentage of the water passed to a level 60 feet higher. Has been in successful operation at Burlington, Vt., for six years. Described by F. H. Parker, Superintendent of Water-Works. Illustrated. *Jour. New England Water-Works Assn.*, September, 1887.
- Water-Pipes.** By A. H. Howland. Treats of the different kinds of pipes, their qualities and availabilities. *Proc. Phila. Engrs. Club*, Vol. VI., p. 55; *Am. Engr.*, April 20, 1887; *Sci. Am. Sup.*, Feb. 12 and Nov. 5, 1887.
- , *Cast-Iron.* Gives a table of dimensions of cast-iron water-pipes as derived from the practice of an experienced engineer. *Mech. World*, Sept. 22, 1888.
- , *Dimensions of.* By J. E. Codman, before the Philadelphia Engineers' Club. Discusses the diameter of pipe-flanges, diameter of bolt circle, size and number of bolts and thickness of cast-iron pipe. Gives diagram to show graphically the above points. *Proc. Engrs. Club, Phila.*, Dec. 1887, Vol. VI., pp. 150-152.
- Water Rates, Uniform Classification of.** Report of a special committee and discussion of same. *Jour. New England Water-Works Assn.*, September, 1887.
- Water Supply, Aeration of.** By S. E. Babcock, before the New England Water-Works Association. Describes the method of aeration adopted at Little Falls, N. Y. It consists of a series of mains constructed in an open paved channel. *Engin. and Build. Rec.*, Jan. 30, 1888; *Sci. Am. Suppl.*, July 14, 1888.
- , *Arrangement of Piping for.* An analysis and description of the piping usually required for water-works pumping stations. By Charles H. Fitch, D. E. *Mechanics*, April.
- , *Biological Examination of a.* By W. T. Sedgwick, before the New England Water-Works Association. Discusses the methods, results and their interpreting of biological examination of water. Discussion *N. Eng. W. Works Assoc.*, June, 1888, Vol. II., pp. 7-26.
- , *Available Rainfall.* See Rainfall.
- , *Capacity of Drainage Ground in Time of Drought.* A study of the capacity of the Sudbury and Lake Cochituate water-sheds in time of drought. By Desmond Fitzgerald. Reprinted in *Jour. New Eng. W. Works Assoc.*, December, 1887.
- , *Consumption by Cities and Towns.* By H. W. Ayres, before the American Water-Works Association. Gives table showing the consumption of water in thirty large cities, extending over a series of years. *Proc. Am. W. W. Assoc.*, Vol. VIII. (1888), pp. 46-49.
- , *Charges for.* Discusses the charges for water by measure and assessment. *Engineering News*, July 28, 1888.
- , *English Towns.* Discusses the bearing of limited water-sheds upon the future supply of English towns, and suggests the prevention of waste of water. Gives experience in the use of waste meters and house-to-house inspection. *Engineer*, June 15 et seq., 1888.
- , *Examination of in Massachusetts.* Abstract of the report of F. P. Stearns,

- Chief Engineer to the State Board of Health of Massachusetts, for 1887. Discusses filter galleries and covered reservoirs. *Eng. and Build. Rec.*, April 14, 1888.
- Water Supply.** *Head Required to Produce Velocities in Pipes.* By Chas. B. Brush, before the Annual Convention of the American Society of Civil Engineers for 1888. Gives results obtained in forcing water through a 20-inch main 75,000 feet long. *Eng. and Build. Rec.*, July 14, 1888; abstracted *Eng. News*, July 7, 1888.
- , *Tokio, Japan.* By Yeiji Nakahima. Gives a good history and description of the water supply of Tokio, Japan, with map and illustrations of wood pipes. *Proc. Amer. Water-Works Assoc.*, 1888, pp. 59-55; *Engin. and Build. Rec.*, March 17, 1888.
- , A paper by A. H. Denman, attorney, before the American Water-Works Association at Minneapolis, on the legal relations existing between water companies and consumers. A valuable digest of a large number of decisions. *Rep. Proc. 7th An. Meet. Am. Water-Works Assoc.*, pp. 82-92. *San. Engr.*, Dec. 31, 1887.
- , *and its Development for Small Cities in the West.* By Wynkoop Kiersted. Considers the question of water supply and its development in the light of past experience. *Engr. News*, Dec. 24.
- , *Hydrant Service, Rental Value of.* By C. E. Chandler, before the Connecticut Association of Civil Engineers and Surveyors. Discusses the question of the proper price to pay for hydrant service. *Proc. Conn. Assoc. of C. E. & Surv.*, 1888, pp. 10-14.
- , *Hydrant Service, Value of.* By J. M. Tubbs, before the Cleveland Convention of the American Water-Works Association. A valuable paper on the methods for an approximate determination of the yearly rental value of fire hydrants as connected with any system of water-works. *Proc. Amer. Water-Works Assoc.*, 1888, pp. 157-168; *Eng. News*, May 5, 1888; *Eng. and Build. Rec.*, April 23, 1888.
- , *Hydrant Service, Rental Value of.* By C. E. Chandler, before the Connecticut Association of Engineers and Surveyors. *Eng. News*, Nov. 19, 1887.
- , *Hydrant Service.* A discussion on the proper charge for hydrant service in *Jour. New Eng. W. Works Assoc.*, September, 1886.
- , *Sanitary Protection of.* A paper by J. M. Tubbs, before the American Water-Works Association. Describes the method adopted for the sanitary protection of the water-shed of Hemlock Lake, supplying water to Rochester, N. Y. *Proc. Amer. Water-Works Assoc.*, 1888, pp. 18-23; *Eng. News*, April 23, 1888.
- , *Stand Pipes.* By B. T. Stevens, before the American Water-Works Association. A valuable paper, giving details of a large number of stand pipes. It also gives practical suggestions on their construction and details of a number of failures. *Proc. Amer. Water-Works Assoc.*, 1888, pp. 102-114; *Engin. and Build. Rec.*, May 12, 1888; *Engr. News*, Oct. 6, 1888.
- , *Sub-Surface for Cities.* A discussion by A. A. Buneman on the use of driven wells. *Engr. News*, May 19, 1888.
- , *Treatment and Sources.* Address of President J. T. Fanning at the eighth annual meeting of the American Water-Works Association. Treats of artificial and natural clarification, deep well supplies, and the protection of sources of supply. *Proc. Amer. Water-Works Assoc.*, 1888, pp. 8-15; *Engr. News*, April 28, 1888; *Engin. and Build. Rec.*, May 5, 1888.
- , *Village.* By S. H. Terry, before Bolton Congress of Sanitary Institute of Great Britain. Gives examples of villages with the different systems of supply, and shows the cost of the works. *Engineering*, Dec. 2, 1887; *Engineer*, Jan. 20, 1888.
- , *Safety Valves.* By S. E. Babcock, before the New England Water-Works Association. Discusses the use of relief and safety valves in water-works distribution systems. Abstracted *Eng. and Build. Rec.*, Sept. 1, 1888.
- , *Southwark and Vauxhall.* Full description, with details of pumping engines, etc. *Engineer*, July 3, etc., 1887.
- , *The Tansa, of Bombay.* By K. Hedges. Gives details of the work in progress to give the city of Bombay a supply of 60,000,000 gallons per day. Gives profile of dam to be 3,500 feet long and 118 feet in height. *Engineer*, July 15, 1887. *Eng. and Build. Rec.*, Dec. 31, 1887.
- , *Widnes.* Illustrated description of the new pumps and method of setting, for the Widnes Water-Works. *Engineer*, Aug. 26, 1887.
- , *Ware, Mass.* A well and reservoir system for town of 6,000. A paper by F.

- L. Fuller, giving a full description and cost. *Jour. New Eng. W. Works Assn.*, Sept., 1887.
- Water Supply, Some Practical Details of the Management of.** A valuable paper by Edwin Darling before the M. E. W. W. Association, with discussion. *Jour. New Eng. W. W. Association*, September, 1887.
- , *Use of Vitrified Pipe in.* By S. E. Babcock, before the American Water-Works Association. Gives experience in the use of salt glazed vitrified pipe for conduit. Describes the conduit at Amsterdam and Little Falls, N. Y. Discussion contains description of a conduit of redwood. *Proc. Amer. Water-Works Assoc.*, 1888, pp. 29-46; *Eng. News*, April 28, 1888; *Eng. and Build. Rec.*, May 26, 1888.
- Water Tower.** Gives detail drawings of a tower 100 feet high, built of gas pipe, for the purpose of elevating a 6,000-gallon water tank at San Antonio, Texas. *Engin. and Build. Rec.*, March 24, 1888.
- Water-Works, Boston.** A description, with plan and section, of the Fisher Hill, Boston, reservoir; also plan and sections of the gate chamber. *Engr. News*, March 24, 1888.
- , *Circleville, Ohio.* A brief description of the Circleville, Ohio, water-works, *Rpt. Ohio Soc. Surv. and Engs.*, 1888, pp. 181-183.
- , *Cleveland, O.* By J. Whitelaw, before the American Water-Works Association. Gives a short description and history of the Cleveland water-works. *Proc. Amer. Water-Works Assoc.*, 1888, pp. 114-123; *Engin. and Build. Rec.*, April 28, 1888.
- , *Cohasset, Mass.* Brief description of the Cohasset, Mass., water-works, with plan showing arrangement of wells, collecting chamber, etc. *San. Engr.*, Dec. 3, 1887.
- , *Denver.* By S. Fortier. Gives a full description of the water-works of Denver, with drawings of many of the details of construction. *Engr. News*, Sept. 22-29, 1888.
- , *Dover, N. H.* Report of Mr. P. M. Blake to the Mayor of Dover on the sources of water supply available for the city. Gives detailed estimate of cost. *Eng. News*, Nov. 26, 1887.
- , *Kansas City, Siphons of the.* By G. W. Pearsons, before the Annual Convention of the American Society of Civil Engineers. Gives description of the siphon constructed at the first water-works in Kansas City. *Trans. Am. Soc. C. E.*, Vol. XVIII., May, 1888, pp. 130-132.
- , *Lawrence, Mass.* A paper by H. W. Rogers. Illustrated. *Jour. New Eng. W. Works Assoc.*, Dec., 1886.
- , *Liverpool Quarry.* Gives method of quarrying, blasting, flagging and dressing stone, with total cost, for the Liverpool water-works. *Engineering*, March 30, 1888.
- , *Mercer, Pa.* Gives brief description of the water-works at Mercer, Pa., with plans of engine house, well and filter. *Engin. and Build. Rec.*, June 9, 1888.
- , *Minneapolis Pumps.* Gives a brief illustrated description of the pumps in use at the Minneapolis water-works. *Engin. and Build. Rec.*, Sept. 15, 1888.
- , *Middletown, Conn., Effluent Pipe.* By E. P. Augur, before the Connecticut Association of Civil Engineers and Surveyors. Describes in detail the adjustable effluent pipe placed in the bottom of reservoir of Middletown water-works. *Proc. Conn. Assoc. C. E. & Surv.*, 1888, pp. 24-35.
- , *Nagpur, India.* Gives a general description of the works for supplying Nagpur, India, with 15 gallons per capita per diem by a gravity system; also contains much information in regard to rainfall, evaporation, discharge and consumption. *Indian Engineering*, March 10 et seq., 1888. Abstracted *Proc. Inst. C. E.*, Vol. XCIII., p. 532.
- , *Racine.* By G. A. Ellis, before the Boston Society of Civil Engineers. Gives a very full description of the water-works at Racine, Wis., and describes method used in the construction of the same. *Jour. Assoc. Engin. Soc.*, April, 1888; *Engin. News*, May 12, 1888.
- Water-Works Statistics,** for many New England cities, for the year 1886, compiled in *Jour. New Eng. Water-Works Assn.*, June, 1887.
- Water Tanks, Iron.** A paper by P. Kieran, and discussion on same. Describes

- 1,160,000 gallon tank at Fall River, Mass. *Jour. New Eng. Water-Works Assoc.*, September, 1887.
- Water Tank, Proper Design for a Hoop Joint of a.** By Prof. J. B. Johnson. Gives the results of tests made on the old forms, and proposes a new design. *R. R. Gaz.* Jan. 6, 1888.
- Water Waste.** A paper by Dexter Brackett. Causes, methods of prevention and results accomplished. *Jour. New Eng. W. Works Assn.*, Dec., 1886.
- Waterways and Railroads.** A paper by U. A. Forbes, before the Society of Arts' Canal Conference. Gives the history of the use and progress of waterways and railroads in England and Wales, and their mutual influence on each other. *Jour. Soc. Arts*, May 25, 1888.
- See Railroads.
- Waves.** A résumé of our present knowledge of wave motion. *Sci. Am. Supple.*, Nov. 19, 1887.
- Weights and Measures, Report of the Committee of the Boston Society on.** Comprising a canvass of the society regarding metric reform, with opinions of members and a notice of the recent act of Congress. *Jour. Assoc. Engin. Soc.*, July, 1888, Vol. VII., pp. 264-271.
- Weir, Automatic Waste.** By A. D. Foote, before the American Society of Civil Engineers. Gives description, with detailed drawing of an automatic waste weir. *Trans. Am. Soc. C. E.*, Vol. XVIII., Sept., 1888, pp. 59-62.
- Wells, Artesian.** By T. B. Comstock. An abstract of a paper discussing the conditions which must exist for artesian wells. *Rpt. Ill. Soc. Engrs. & Surv.*, 1888, pp. 120-126.
- Wire Gauges.** *Chart showing properties of all wire gauges in use.* Compiled by S. S. Wheeler. The most complete exposition of the subject yet made. *The Electrical World*, Nov. 12, 1887.
- Woodite.** By Sir Edward Reed. Discusses the use of a new structural material, the base of which is rubber. It appears to be coming into general use in many ways. *Sci. Am. Supple.*, March 31, 1888.
- Wood Pulp Vulcanization.** By M. L. Deering. Describes a new method of treating fibrous material. *Jour. Assoc. Engin. Soc.*, Feb., 1888, pp. 52-55.
- Yacht, Grace Darling.** Gives a brief description, with two page plate, showing longitudinal section, deck plan and cabin plan of the steam yacht "Grace Darling." Length over all, 157 ft.; breadth, 19½ ft.; depth, 11 ft.; draught, 8 ft.; tonnage, 239 tons; engines, quadruple expansion; cylinders, 10 in., 14 in., 20 in. and 28 in. diameter, with 20 in. stroke; 160 rev. per minute; 360 horse-power, with boiler pressure of 180 lbs. *Engineer*, March 16, 1888.
- Yachts, Racing and Cruising.** Remarks on the length, beam and sail area of racing and cruising yachts, with suggestions for defining cruisers and for regulating races. Gives tables showing leading dimensions and antics of British and American yachts. *Engineering*, Nov. 25 et seq., 1887.

NOTE.—For all Government publications and information concerning the same, send to J. H. Hickcox, 906 M street W, Washington, D. C.

ENGINEERS' CLUB OF KANSAS CITY.

NOVEMBER 4, 1889.—A regular meeting was held in the club room at 8 P. M., Vice-President Breithaupt in the Chair, Kenneth Allen, Secretary. There were present eight members and seven visitors.

Minutes of the last regular meeting and meetings of the Executive Committee were read and approved.

The resignation of Mr. F. Allen, as Librarian, on account of change of residence, was presented, and on motion of Mr. F. W. Tuttle it was voted that the Chair appoint a Librarian to act until the end of the year.

The Secretary announced the receipt of 13 pamphlets on Harbor Studies, Permeability of Cements, Rapid Transit, etc., from Prof. L. M. Haupt, and illustrations of the Poetsch-Soosmith Method of Shaft-Sinking from that company.

On canvass of ballots John R. Braidwood and Robt. M. Sheridan were declared elected Members, and Thos. H. Ashburner as Associate.

The paper on "Building Stones," read Oct. 7, was discussed by Messrs. G. W. Pearsons and Thos. Knight.

A short article from Mr. F. E. Sickels, on "Sewer Ventilation," and one on "Sewage Disposal," by K. Allen, were read by the Secretary and discussed by Messrs. G. W. Pearsons and T. Knight.

A paper from Prof. L. M. Haupt on "A Plan for Outer Harbor off Padre Island, Texas," was read by the Secretary; also a letter from Mr. A. Bonzano indorsing the project; and a paper by Mr. John Willett, on the commercial aspect of such an harbor, was read by the author, illustrated by designs and coast survey charts. The plan contemplates building an iron pier out into the Gulf, 4,500 feet from shore. Then constructing a wharfage sufficient for thirty of the larger ocean vessels and two hundred sail of coasters. He considered this plan far more practicable and wise than to attempt to maintain a channel through the bar that guards entrance to the entire Texas coast. The plan could be carried out in twenty months, and the case of Ceare, Brazil, was cited, where a similar outer harbor, 7,000 feet from the shore, is an absolute realization of all expectations.

After discussion by Messrs. G. W. Pearsons, Thos. Knight and H. H. Filley, Thos. F. Callahan was proposed as Associate by F. C. Gunn and Edw. Butts, and W. J. Lightfoot as Member by Kenneth Allen and W. H. Breithaupt.

[Adjourned].

KENNETH ALLEN, Secretary.

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INDEX DEPARTMENT.

ANNUAL SUMMARY.

It is proposed to furnish, in this department, as complete an Index as may be of current engineering literature of a fragmentary character. A short note will be appended to each title, intended to give sufficient information to enable the reader to decide whether or not it is worth his while to obtain or consult the paper itself. The Index will be mostly limited to society and magazine articles, and special engineering reports of general interest and value. It is printed in the monthly issues of the JOURNAL, on but one side of the paper, so that the titles may be cut out and pasted on cards or in a book, and is here collected with additional titles and many cross references.

LIST OF PERIODICALS INDEXED.

American Architect (Am. Arch.), weekly, Ticknor & Co., 211 Tremont street, Boston, Mass.; single copy, 15 cents.

American Engineer (Am. Engr.), weekly, Gaff Building, Chicago, Ill.; per year, \$2; single copy, 5 cents.

American Machinist (Am. Mach.), weekly, 96 Fulton street, New York; per year, \$2.50; single copy, 5 cents.

American Manufacturer and Iron World (Am. Mfr.), weekly, Pittsburgh, Pa.; per year, \$4; single copy, 10 cents.

Electrical Review (Elec. Rev.), weekly, 22 Paternoster Row, London, E. C.; per year, 21s. 8d.; single copy, 4d.

Engineering and Building Record (Eng. & Build. Rec.), weekly, 277 Pearl street, New York; per year, \$4; single copy, 10 cents.

Engineering News (Eng. News), weekly, Tribune Building, New York; per year, \$5; single copy, 12 cents.

Engineering and Mining Journal (E. & M. Jour.), weekly, 27 Park Place, New York; per year, \$4; single copy, 10 cents.

Engineering (Lond. Eng.), weekly, London, England; per year, \$10; single copy, 25 cents.

Indian Engineering (Ind. Eng.), weekly, Calcutta, India; 18s. per year; single copy, 8 Annas.

Journal of the Franklin Institute (Jour. Fran. Inst.), monthly, Franklin Institute, Philadelphia, Pa.; per year, \$5; single copy, 50 cents.

Journal of the Association of Engineering Societies (Jour. Assn. Eng. Soc.), monthly, 73 Broadway, New York; per year, \$3; single copy, 30 cents.

Journal of the Society of Arts (Jour. Soc. Arts), weekly, London, England; single copy, 6d.

Mechanics (Mechanics), monthly, 907 Arch Street, Philadelphia, Pa.; per year, \$1; single copy, 10 cents.

Power (Power), monthly, 113 Liberty Street, New York; per year, \$1; single copy, 10 cents.

Proceedings American Institute of Mining Engineers (Proc. A. I. M. E.), 13 Burling Slip, New York; per year, \$5.

Proceedings of the United States Naval Institute (Proc. U. S. N. I.), quarterly, United States Naval Institute, Annapolis, Md.; per year, \$3.50; single copy, \$1.

Progressive Age (Prog. Age), semi-monthly, 30 Park Place, New York; per year, \$5; single copy, 15 cents.

Railroad and Engineering Journal (R. R. & Eng. Jour.), monthly, 45 Broadway, New York; per year, \$3; single copy, 25 cents.

Railroad Gazette (R. R. Gaz.), weekly, 73 Broadway, New York; per year, \$4.20; single copy, 10 cents.

Railway Review (Ry. Rev.), weekly, The Rookery, Chicago, Ill.; per year, \$4.

Scientific American Supplement (Sci. Am. Sup.), weekly, 361 Broadway, New York; per year, \$5; single copy, 10 cents.

Street Railway Journal (St. Ry. Journ.), monthly, 113 Liberty street, New York, per year, \$2.

The Electrical Engineer (Elec. Engr.), monthly, 11 Wall street, New York; per year, \$3; single copy, 30 cents.

The Electrical World (Elec. World), weekly, 177 Times Building, New York; per year, \$3; single copy, 10 cents.

The Engineer (Lond. Engineer), weekly, London, England; per year, \$10; single copy, 25 cents.

The Railway Master Mechanic (Mast. Mech.), monthly, "The Rookery," Chicago, Ill.; per year, \$1; single copy, 10 cents.

The Mechanical World (Mech. World), weekly, Manchester, England; per year, 8s. 8d.; single copy, 1 penny.

The Street Railway Gazette (St. Ry. Gaz.), monthly, 8 Lakeside Building, Chicago; per year, \$2; single copy, 25 cents.

Transactions American Society of Civil Engineers (Trans. A. S. C. E.), 127 East Twenty-third street, New York; per year, \$10.

Abt Rack-Rail System for Mountain Railroads. See Railroads.

Accidents. See Railroad Accidents.

— *in Mines.* A paper by Sir Fred A. Abel, giving general review of legislation on in England, and of causes and remedies which now obtain. *Proc. Inst. Civ. Engr.*, Vol. XC., p. 160.

Address. *Annual Address of Prcs. of Am. Soc. C. E.* Delivered at Seabright, N. J., by Max J. Becker, President. Pp. 20. *Trans. Am. Soc. C. E.*, June, 1889, Vol. XX., p. 233.

— *of the President Boston Soc. of C. E.* Delivered by Desmond FitzGerald, March 20, 1889. *Jour. Ass'n. Eng. Soc.*, May, 1889, Vol. VIII., p. 251.

Air Compressor, built in sections for transportation over mountainous countries on mule back. Illustrated. *E. & M. Jour.*, June 1, 1889.

— Improved form of Automatic Regulator for Air and Steam. *E. & M. Jour.*, May 11, 1889.

Air-Compressing Machinery, Lubrication of. See Lubrication.

Algerian Railways. An account of the railways of Algiers. By Consul Grellet, of Algiers. *U. S. Consul's Reports*, April, 1889.

Alloys of Iron and Silicon. See Iron.

— *of Nickel and Steel.* A paper read before the Iron and Steel Institute. By James Raley, of Glasgow. *Sci. Am. Supp.*, August 24, 1889.

— *Strength of Alloys at Different Temperatures.* See Strength of Alloys.

Alpine Engineering. *A descriptive account*, with plates, of the various railways in the Alps. By Vernon Harcourt. *Proc. Inst. Civ. Engr.*, Vol. XCV.

Alternating Current Motors, Difficulties in the way of electric transmission of power by. See Electric Transmission of Power.

— Machinery. See Electricity.

Aluminum. Its Production by the Hall Process. A new electrolytic process by which aluminum is produced continuously, directly from alumina, at a single operation. *Elec. World*, Sept. 21, 1889.

— A lecture delivered at the Royal Institution of Great Britain treating of the properties, manufacture and uses of this metal. By Sir Henry Roscoe. *Sci. Am. Supp.*, August 24, 1889.

— A lecture delivered before the Franklin Institute by Hanford Henderson, Professor of Chemistry and Physics, Philadelphia Manual Training School. An interesting account of the various processes used to obtain metallic aluminum. *Sci. Am. Supp.*, Jan. 5, 1889.

— *and its Extraction on a Commercial Basis.* By F. J. Seymour. *Sci. Am. Supp.*, Aug. 24, 1889.

— *and Silica in Cast Iron, Effects of.* See Silica.

— *the "Heroult" Process.* Full description, with illustrations of the plant used. *Eng. and Min. Jour.*, Dec. 1, 1888; *Am. Mfr. and Iron World*, Nov. 23, 1888.

American Blast Furnace Practice, Notes on. See Blast Furnace Practice.

American Institute of Mining Engineers. Some Thoughts Relating to Am. Inst. M. E., and its mission. Presidential address at New York meeting, February, 1889, by William B. Potter, St. Louis, Mo.

Ammonia, Properties of. Abstract of Paper by De Volson Wood, presented at Convention of Am. Soc. Mech. Eng., at Erie, May, 1889. *Mechanics*, June, 1889.

— *Engines. The Theory of.* See Engines.

Anthracite Coal. Table giving weights per cubic foot and specific gravity of anthracite broken to market sizes. *E. & M. Jour.*, June 1, 1889.

Aqueduct Masonry, Cost of, in Detail. See Masonry.

— *New Croton, Head House at Shaft 17.* See Head House.

— Report of experts appointed to examine and report on the condition of the Washington Aqueduct Tunnel. *Senate Report No. 2,686*, 50th Cong., 2d Sess.

— *Washington.* Profile and sections of the new Washington Aqueduct Tunnel, with progress report. *An. Rept. Chf. Engrs., U. S. A.*, 1888. Vol. IV., p. 2,766.

Arch. An Error in a Common Theory of the Masonry Arch. A valuable discussion of the line of resistance in arches subjected to earth pressure. By Prof. I. O. Baker. *R. R. Gaz.*, May 31, 1889.

— *Bridge. The Colorado Street Skew Arch Bridge, St. Paul.* See Skew Arch Bridge.

- Arch of Brick and Masonry.** A very good paper of 28 pp. By A. Wharton Metcalfe. Gives new tables for computing the form of arch suitable for any fixed load. Illustrated. *Trans. Liverpool Eng. Soc.*, Vol. VII., p. 19 (1886).
- . **Arched Ribs and Vauissior Arches.** A paper by H. M. Martin, giving the theory in concise form. *Proc. Inst. Civ. Engrs.*, XCIII., p. 462.
- Artesian Well at St. Augustine, Fla.**, 1,390 feet deep; capacity, 10,000,000 gallons in 24 hours. Pressure of discharge sufficient to force the jet 42 feet above mouth of well. *Eng. News*, April 6, 1889.
- Asphalt and its uses.** By F. V. Greene, New York City. General descriptions, where found, chemical composition, methods of using, durability, etc. Illustrated, pp. 19. *Proc. A. I. M. E.*, Buffalo meeting, 1888.
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- . **Pavements on Concrete Foundations in New York.** Summary of specifications respecting preparation of street surface, foundations, and mixing and laying the asphalt wearing surface. *Eng. News*, Nov. 16, 1889, Vol. XXII., p. 473.
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